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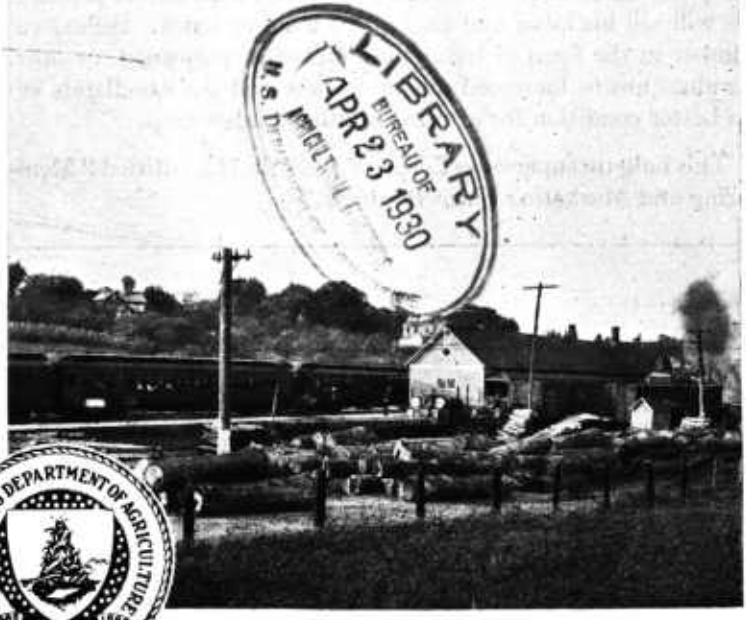
MEASURING AND MARKETING FARM TIMBER



FARMERS GENERALLY know how to estimate and measure ordinary field crops much better than they do logs and standing trees.

Timber has long afforded a considerable part of the net cash income from the farm. It is important therefore that owners of woodlands inform themselves about the different kinds of timber products, the methods of estimating and measuring them, as well as their value, the current market prices, and methods of selling any surplus products not needed for their own use. Such knowledge will prove much to the advantage of timberland owners.

It is advisable so far as possible for the owner to cut or harvest his own timber crop. Thus along with the rough timber products he will sell his labor and that of his team or truck. Selling cut timber in the form of logs, poles, crossties, pulpwood, or other product means increased money income and the woodlands left in better condition for growing another timber crop.

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MEASURING AND MARKETING FARM TIMBER

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CONTENTS

INTRODUCTION

LACK OF FAMILIARITY with the estimating and selling of timber usually puts woodland owners at a disadvantage, and in many instances material from the woods is sold for considerably less than its real value. The loss to the farmers is, in the aggregate, very large. In order to stop this loss, it is necessary that the farmer inform himself about the different kinds and grades of timber products, the methods of estimating and measuring them and ascertaining their real value, the methods of selling, the markets, and the current market prices. Especially does he need reliable information about the amount and real value of his standing timber (fig. 1) and the location of good markets. It is the aim of this bulletin to assist woodland owners in getting information of this kind, so that they may market their forest products at fair prices.

PRINCIPAL WOOD PRODUCTS

LOGS

Many wood-manufacturing industries obtain their raw material in the form of logs and bolts. Logs may be sold by sizes and grades or without classification by the lot. Selling "log run" is simple and direct but offers good opportunity for speculation, usually to the advantage of the buyer whose knowledge of timber is better than that of the seller. The method is advisable only after the owner has made a careful estimate of the amount and quality of the standing timber. Selling by sizes and grades, when these are defined in the contract, often results in larger money returns.

The quality of a log depends upon its dimensions and grade. Logs are inspected for the number and character of standard defects, which determine the grade, and are measured by taking the length and the average diameter at the small end. Large logs are more valuable than small ones of the same grade. (Fig. 2.)

[1] Mr. Barrows's contribution deals with the subject of measuring and is found on pp. 15 to 35, inclusive.

For example: In one market medium grade 10-foot red-oak logs from 16 to 30 inches in diameter were worth $19 per 1,000 feet;

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FIGURE 1.—Farmers are giving thought to the selection of their trees for different kinds of marketable products

logs from 31 to 36 inches in diameter, $23; and logs 37 inches and over in diameter, $25. Logs with only slight defects or none were

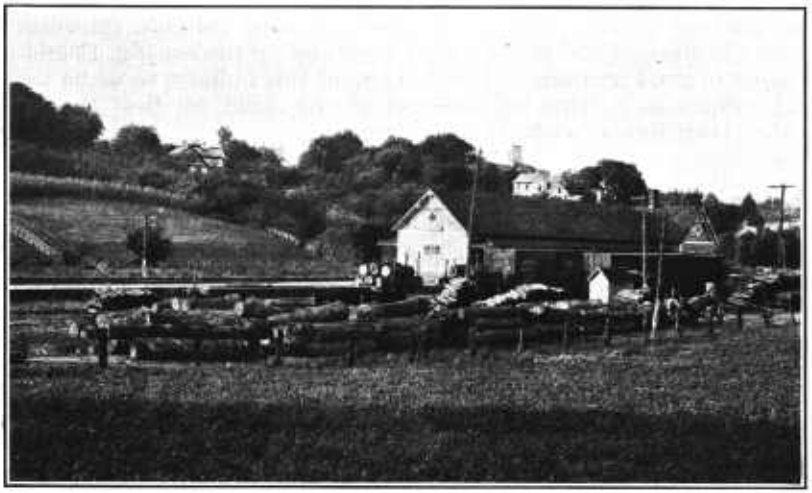

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FIGURE 2.—High-grade logs such as these, from farm woodlands, can be profitably shipped by rail to outside markets. (White oak, yellow poplar, ash, and basswood)

worth from $6 to $10 more, and logs with more defects were worth from $3 to $5 less than these prices.

GRADING

The grade of a log depends upon the number and character of its defects. Among those recognized by the lumberman as standard are knots, rot, shakes, season checks, frost cracks, sun scald, fire scars, seams, wormholes, stain, spiral or crooked grain, cat faces, and crook in the log. In general, grading is more common and the number of grades is larger for the more valuable woods than for the inferior kinds of timber.

Unfortunately, there are no standard specifications for log grades. Rough local grades are in quite general use but are not defined. They are of only limited aid to the seller because they are subject to differences of interpretation.

The adoption by some acknowledged authority and the recognition throughout a State or region of a few standard grades and sizes for logs of various kinds of trees would be of very great assistance in the marketing of farm timber. It would afford common ground on which the buyer and seller might meet.[2]

Three rough grades are in use in many parts of the eastern United States. These are commonly known as No. 1, No. 2, and No. 3, or as "good," "common," and "cull." In some regions a No. 1 log must cut its full scale in No. 1 common lumber or better, a No. 2 log must saw out two-thirds of the scale in No. 1 common or better, and a No. 3 log must cut one-half of its scale in No. 2 common with a little of the better grades. Two small limb knots are allowed in a No. 1 log, but two large knots or body knots make it a No. 2 grade, and, if they occur at each end, a cull log. Exterior checking and shallow cat faces are not defects, since they go in to the slab only.

In practice, the second grade sells for about two-thirds and the third grade for about one-half, or less, the price of the first grade. In some localities only two grades are used.

Other forms of grading used in different regions are: Grade No. 1, logs 10 inches and over in diameter with surface and ends clear of defect, and sapwood bright in color; grade No. 2, logs having not more than three standard defects, or slightly wormy; and grade No. 3, logs falling below the No. 2 grade, chiefly because of worm and rot defects.

The veneer industry secures most of its raw product in the form of logs and flitches (large-sized pieces sawed from logs). Both are sold by the thousand board feet. The specifications are not uniform. The essential points refer to the species, the size of the logs, and the grade of the wood. Diameters for hardwoods run mostly from 14 inches up, and lengths from 6 to 16 feet. Logs must be cut 4 inches over the specified length to allow for trimming. The rules for yellow poplar given below will serve as an illustration of the manner of grading, although to make the specifications complete the defects would have to be defined. Very few logs meet the requirements of the No.1 grade, and the buyer exercises discretion in departing more or less from this standard.

No. 1 yellow poplar logs must be straight-grained and free from knots, crook, cat faces, wind-shakes, rotten center, double hearts, hearts grown to one side, and other defects. These specifications

[2] There is an oppurtunity for the various State forestry organizations in cooperations with lumber associations to work for the adoption of standard log grades in their States.

apply to logs up to and including 12 feet in length; logs 14 feet and 16 feet long may have one defect not over 6 inches in diameter; logs over 16 feet feet long may have two defects not over 6 inches in diameter; also a log may have a hole in the center not greater than one-fifth of the diameter of the log.

No. 2 yellow poplar logs must be the same as No.1, except that they may have defects not to exceed one-third of the circumference.

Cull logs are those that grader poorer than No. 2.

Logs will command full price when freshly cut, but logs that have suffered from exposure are not desirable under any circumstances and will at no time bring any but low prices. Diameters will be measured across the top end of the log and the contents scaled by the log rule agreed upon. (See pp. 19 to 20.)

WEIGHT

A knowledge of the average weights of logs of different species in a green and a dry state is useful in calculating the cost of handling the material and making shipments by rail. Table 1 shows the approximate weights for logs, bolts, cordwood, and rough lumber.

TABLE 1.—*Approximate weights of various wood products* [1]

Species	Lumber (per 1,000 board feet)			Logs (per 1,000 board feet log scale, Doyle rule) [2]						Cordwood, bolts, butts, etc., per cord [2]	
				12 inches diameter [3]		18 inches diameter [3]		24 inches diameter [3]			
	Air-dry	Green [1]	Rough (classed as 1 inch thick) "shipping dry"	Green	Dry	Green	Dry	Green	Dry	Green	Dry
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Ash, white	3,500	4,000	[4] 3,800	11,100	9,700	7,700	6,800	6,600	5,700	4,300	3,800
Aspen (popple)	[5] 2,200	3,900	2,250	10,800	6,200	7,600	4,300	6,400	3,700	4,200	2,400
Basswood	2,100	3,400	[4] 2,500	9,500	5,900	6,600	4,100	5,600	3,500	3,700	2,300
Beech	3,600	4,600	[4] 4,000	12,700	10,100	8,900	7,000	7,500	6,000	5,000	3,900
Birch, yellow	3,700	4,800	[4] 4,000	13,200	10,300	9,200	7,200	7,800	6,100	5,100	4,000
Cedar, western red	1,900	2,200	[6] 3,000	6,200	5,300	4,300	3,700	3,700	3,100	2,400	2,100
Cherry, black	3,000	3,800	[4] 3,800	10,500	8,300	7,300	5,800	6,200	4,900	4,100	3,200
Chestnut	2,500	4,600	[4] 2,800	12,600	7,000	8,800	4,900	7,500	4,100	4,900	2,700
Cottonwood	2,200	3,600	[4] 2,800	10,700	6,300	7,500	4,400	6,300	3,700	4,200	2,500
Cypress, southern	2,800	4,200	[4] 3,000	11,800	7,800	8,200	5,500	7,000	4,600	4,600	3,100
Elm:											
White	2,900	4,000	[4] 3,100	11,300	7,800	7,900	5,500	6,700	4,600	4,400	3,100
Slippery	3,300	4,600	[4] 4,000	12,600	9,200	8,800	6,400	7,400	5,500	4,900	3,600
Fir:											
Balsam	2,100	3,700	------	10,400	5,800	7,200	4,000	6,100	3,400	4,000	2,200
Douglas	2,800	3,100	[1] 3,300	8,700	7,700	6,100	5,400	5,200	4,600	3,400	3,000
Gum:											
Black	3,000	3,700	[4] 2,800	10,400	8,300	7,200	5,800	6,100	4,900	4,000	3,200
Red (sweet)	2,800	3,900	[4] 3,300	10,600	8,100	7,400	5,600	6,300	4,800	4,200	3,100
Hackberry	3,500	4,400	[4] 3,200	11,300	8,900	7,900	6,200	6,700	5,200	4,400	3,500
Hemlock (eastern)	2,400	4,000	[7] 2,500	11,200	6,600	7,800	4,600	6,600	3,900	4,400	2,600
Hickory	4,300	5,200	[4] 4,500	14,700	11,900	10,300	8,300	8,700	7,000	5,700	4,600

[1] These weights and those in Tables 2, 3, and 5 are not the shipping weights prescribed by any railroad or any State railroad commission. The weights here given for "green" lumber are based largely upon the weights of wood cut and shipped in the log for varying distances to the Forest Products Laboratory, Madison, Wis., for purposes of testing. The "green" weights for lumber are thus not the weights of the wood when cut. There is no recognized standard green weight for wood.

[2] Weights of logs and cordwood computed from A. K. Armstrong's weights of hardwood per cubic foot (90 cubic feet per cord).

[3] Diameter inside bark at small end.

[4] Weights of rough lumber are official standard weights of the National Hardwood Lumber Association, unless otherwise indicated.

[5] Lumberman's Bureau.

[6] West Coast Lumberman's Association.

[7] Engineering News, vol. 63, No. 18.

TABLE 1.—*Approximate weights of various wood products*—Continued

Species	Lumber (per 1,000 board feet)			Logs (per 1,000 board feet log scale, Doyle rule)						Cordwood, bolts, butts, etc., per cord	
				12 inches diameter		18 inches diameter		24 inches diameter			
	Air-dry	Green	Rough (classed as 1 inch thick) "shipping dry"	Green	Dry	Green	Dry	Green	Dry	Green	Dry
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Juniper (western)										4,000	3,200
Locust, black	4,100	4,800		13,400	11,300	9,300	7,900	7,900	6,700	5,200	4,400
Maple:											
Sugar	3,600	4,700	[4] 3,900	12,900	10,000	9,000	7,000	7,600	5,900	5,000	3,900
Red	3,000	4,300	[4] 3,300	11,900	8,200	8,300	5,700	7,100	4,900	4,700	3,200
Silver	2,800	3,800	[4] 3,300	10,500	7,800	7,300	5,400	6,200	4,600	4,100	3,000
Oak:											
Red	3,600	5,400	[4] 4,000	14,800	10,400	10,300	7,300	8,800	6,200	5,800	3,900
White	4,000	5,200	[4] 4,000	14,400	10,900	10,000	7,600	8,500	6,500	5,600	4,300
Pine:											
Jack	2,500	4,200		11,500	6,900	8,000	4,800	6,800	4,100	4,500	2,700
Loblolly	3,200	4,500		12,400	9,000	8,700	6,300	7,400	5,300	4,300	3,200
Longleaf	3,500	4,000	[8] 3,500	11,100	9,700	7,700	6,800	6,500	5,700	4,000	3,500
Norway (red)	2,800	3,500		9,700	7,800	6,800	5,500	5,700	4,600	3,500	2,800
Pinon										3,900	3,000
Pitch	3,000	4,500		12,400	8,300	8,700	5,800	7,400	4,900	4,900	3,200
Shortleaf	3,000	3,700	[8] 3,300	10,400	8,300	7,200	5,800	6,100	4,900	4,000	3,200
Slash	3,700	4,400		12,200	10,400	8,500	7,200	7,200	6,100	4,800	4,000
Sugar	2,200	4,200		11,500	6,200	8,000	4,300	6,800	3,700	4,500	2,400
Western yellow	2,300	4,100	[9] 2,600	11,300	6,500	7,900	4,500	6,700	3,800	4,400	2,500
White	2,200	3,200	[7] 2,400	9,000	6,200	6,300	4,300	5,300	3,700	3,500	2,700
Poplar, yellow (tulip)	2,400	3,200	[4] 2,800	8,800	6,500	6,100	4,500	5,200	3,800	3,400	2,500
Redwood	2,100	3,200	[10] 2,100	8,900	5,900	6,200	4,100	5,200	3,500	3,500	2,300
Spruce, eastern	2,400	2,800		7,700	6,600	5,400	4,600	4,600	3,900	3,000	2,600
Sycamore	3,000	4,300	[4] 3,000	12,000	8,300	8,400	5,800	7,100	4,900	4,700	3,200
Tupelo gum (bay poplar)	3,000	5,500	[4] 2,800	15,200	8,500	10,600	5,900	9,000	5,000	5,900	3,300
Walnut, black	3,000	4,500	[4] 3,800	11,900	8,200	8,300	5,700	7,100	4,900	4,700	3,200
Willow	2,100	4,300	[4] 2,800	11,800	6,000	8,200	4,200	7,000	3,500	4,600	2,300

[4] Weights of rough lumber are official standard weights of the National Hardwood Lumber Association, unless otherwise indicated.
[7] Engineering News, vol. 63, No. 18.
[8] Southern Pine Association.
[9] Western Pine Manufacturers' Association.
[10] California Redwood Association.

BOLTS AND BILLETS

Bolts are short portions of logs. Billets are obtained by halving, quartering, or otherwise splitting or sawing bolts or short logs lengthwise. Handle and spoke blanks and cooperage blocks are good examples of billets. In the southern pine region the terms bolts and billets mean exactly the opposite of these definitions. Billets thus are short round logs. Because splitting causes a great deal of waste, it has been largely superseded by sawing. For example, a cord of average-sized hickory bolts that will yield only about 700 rived spoke billets may be sawed into 900 billets. Bolts and billets are used for such products as cooperage, wood pulp, excelsior, woodenware (pails and tubs), handles, vehicle parts, some agricultural implements, fruit and vegetable packages, athletic goods, and pencils.

Cooperage plants consume very large quantities of material which comes from the woods in the form of bolts and billets. (Fig. 3.) Wood pulp is made from pieces of many shapes and sizes. Much of the raw material used by the handle and wheel industries is ash

and hickory bolts and billets, the hickory going into ax and hammer handles and wagon and automobile spokes and the ash into hoe, rake, and shovel handles.

Bolts are measured and sold by the cord, by the linear foot, and by the board foot. If 12 inches or over in diameter, they are usually sold by board measure. Billets are frequently sold by the piece or count, particularly if sawed and of uniform size, or are stacked and measured in cords, either standard or short cords of specified width. Table 2 gives the weight per stack of bolts of different kinds of wood and of different lengths and diameters.

The grades and specifications used in slack cooperage are very numerous; but the forms and qualities for tight-cooperage stock,

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FIGURE 3.—Stave bolts and billets of white and red oak, cut 36 inches to make 34-inch staves

including staves, hoops, and heading, are much restricted. Specifications refer to the species, length, width, thickness, and soundness of timber. The white oaks are practically the only woods used in the manufacture of tight cooperage; but many different kinds of wood may be made into barrels for flour, sugar, vegetables, salt, cement, lime, etc.

For handle stock, the specifications call for second-growth, straight, sound bolts or billets of specified length. Ash bolts for farm-tool handles are mostly from 30 to 60 inches in length. For hammer, ax, and other handles, hickory is bought under similar conditions but including shorter lengths. Material which is inferior to that called for is frequently accepted, especially when the users are in urgent need of supplies.

TABLE 2.—*Approximate weights per stack of bolts, green and dry, of different kinds of wood and of different lengths and diameters* [1]

Species	Average diameter of bolt or stick	Length of bolt (feet)								Weight per cubic foot (solid wood)
		2½ (⅝ cord)	3 (¾ cord)	3½ (⅞ cord)	4 (1 cord)	4½ (1⅛ cords)	5 (1¼ cords)	5½ (1⅜ cords)	6 (1½ cords)	
		Weight per stack (pounds)								
Ash, white:	*Inches*									*Pounds*
Green [2]	6	2,600	3,200	3,700	4,200	4,800	5,300	5,800	6,300	48
	9	2,800	3,300	3,900	4,400	5,000	5,500	6,100	6,600	
	12	2,900	3,400	4,000	4,600	5,100	5,700	6,300	6,900	
Air-dry	6	2,300	2,800	3,200	3,700	4,200	4,600	5,100	5,600	41
	9	2,400	2,900	3,400	3,900	4,400	4,800	5,300	5,800	
	12	2,500	3,000	3,500	4,000	4,500	5,000	5,500	6,000	
Basswood:										
Green [2]	6	2,300	2,700	3,200	3,600	4,100	4,500	5,000	5,500	41
	9	2,400	2,800	3,300	3,800	4,300	4,700	5,200	5,700	
	12	2,500	2,900	3,400	3,900	4,400	4,900	5,400	5,900	
Air-dry	6	1,400	1,700	2,000	2,300	2,600	2,800	3,100	3,400	26
	9	1,500	1,800	2,100	2,400	2,700	3,000	3,300	3,600	
	12	1,500	1,800	2,100	2,500	2,800	3,100	3,400	3,700	
Cottonwood:										
Green [2]	6	2,600	3,100	3,600	4,100	4,600	5,100	5,600	6,100	49
	9	2,700	3,200	3,700	4,300	4,800	5,300	5,900	6,400	
	12	2,800	3,300	3,900	4,400	5,000	5,500	6,100	6,600	
Air-dry	6	1,500	1,800	2,100	2,400	2,700	3,000	3,300	3,600	28
	9	1,600	1,900	2,200	2,500	2,800	3,100	3,500	3,800	
	12	1,600	1,900	2,300	2,600	2,900	3,200	3,600	3,900	
Elm, rock and white:										
Green [2]	6	2,700	3,200	3,700	4,300	4,800	5,300	5,900	6,400	54
	9	2,800	3,400	3,900	4,500	5,000	5,600	6,100	6,700	
	12	2,900	3,500	4,000	4,600	5,200	5,800	6,300	6,900	
Air-dry	6	1,900	2,300	2,700	3,000	3,400	3,800	4,200	4,600	40
	9	2,000	2,400	2,800	3,200	3,600	4,000	4,400	4,800	
	12	2,100	2,500	2,900	3,300	3,700	4,100	4,500	4,900	
Hickory, shagbark:										
Green [2]	6	3,500	4,200	4,900	5,600	6,300	7,000	7,700	8,400	64
	9	3,700	4,400	5,100	5,900	6,600	7,300	8,100	8,800	
	12	3,800	4,500	5,300	6,100	6,800	7,600	8,300	9,100	
Air-dry	6	2,800	3,400	4,000	4,500	5,100	5,700	6,200	6,800	51
	9	3,000	3,600	4,100	4,700	5,300	5,900	6,500	7,100	
	12	3,100	3,700	4,300	4,900	5,500	6,100	6,700	7,300	
Oak, white:										
Green [2]	6	3,400	4,100	4,800	5,500	6,200	6,800	7,500	8,200	63
	9	3,600	4,300	5,000	5,800	6,500	7,200	7,900	8,600	
	12	3,700	4,500	5,200	6,000	6,700	7,500	8,200	9,000	
Air-dry	6	2,600	3,100	3,600	4,200	4,700	5,200	5,700	6,200	47
	9	2,700	3,300	3,800	4,400	4,900	5,500	6,000	6,600	
	12	2,800	3,400	4,000	4,500	5,100	5,700	6,200	6,800	
Pine, shortleaf:										
Green [2]	6	2,500	3,000	3,400	3,900	4,400	4,900	5,400	5,900	51
	9	2,600	3,100	3,600	4,100	4,700	5,200	5,700	6,200	
	12	2,700	3,200	3,800	4,300	4,800	5,400	5,900	6,400	
Air-dry	9	2,000	2,400	2,800	3,200	3,500	3,900	4,300	4,700	38
	9	2,100	2,500	2,900	3,300	3,700	4,100	4,600	5,000	
	12	2,100	2,600	3,000	3,400	3,900	4,300	4,700	5,200	
Pine, white:										
Green [2]	6	2,100	2,600	3,000	3,400	3,800	4,300	4,700	5,100	36
	9	2,200	2,700	3,100	3,600	4,000	4,500	4,900	5,400	
	12	2,300	2,800	3,300	3,700	4,200	4,700	5,100	5,600	
Air-dry	6	1,500	1,800	2,100	2,400	2,700	3,000	3,200	3,500	25
	9	1,600	1,900	2,300	2,500	2,800	3,100	3,400	3,700	
	12	1,600	1,900	2,300	2,600	2,900	3,200	3,500	3,900	

[1] Stacks are 4 feet in height by 8 feet long, made up of bolts of different sizes. Bolts 4 feet long make a standard cord, while shorter lengths make "short cords," and longer lengths a cord and over.

[2] The green weight or the weight of wood before it is air-dry varies widely. The weights here given are based upon the weights of logs shipped in by rail to the Forest Products Laboratory, Madison, Wis., for purposes of testing.

POLES

Southern pines (fig. 4) treated with creosote, chestnut and eastern white cedar furnish the bulk of the southern and eastern pole timber. Specifications for poles generally require material to be of the best

quality, of specified dimensions, butt cut, squared at both ends, reasonably straight, well proportioned from top to butt, peeled, and with knots trimmed close. Defects looked for in inspection are crookedness, split tops and butts, sap and butt rot, checks, and shakes. Chestnut poles are assigned to two or three classes, according to their length, top circumference, and circumference measured at 6 feet from the butt. Poles of the 40-foot class, for example, are required by one representative pole company to be 24 inches in top circumference [3] and 48 inches in basal circumference, while second-class poles of the same length measure only 22 and 46 inches, respectively, at the two points. Peeled pine poles are classed mostly in 5-foot

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FIGURE 4.—Harvesting 2 acres of longleaf pine poles grown at a large profit to the owner on an abandoned cotton field in southern Mississippi. Such poles are in strong demand

lengths above 20 feet and are required to be of certain diameters across the top ends. The lengths run to 100 feet.

The dimensions shown in Table 3 for classes A, B, and C, with only slight modifications, are used by most telegraph and railroad companies and other purchasers of poles. The corresponding cubic contents and weights shown will be useful in making shipments. The figures are too low by from 10 to 20 per cent for full-bodied trees with small butt swell and likewise too high for trees with a marked basal swell.

As poles season they become lighter and in one year lose about 20 per cent of their weight when green. Table 4 shows the loss in weight in chestnut poles due to seasoning for monthly periods up to 15 months. To determine the approximate weight of chestnut poles after partial seasoning, apply the percentage of loss in weight shown in Table 4 to the green weight in Table 3.

[3] Equivalent to 7.6 inches in diameter.

TABLE 3.—*Approximate weights of green chestnut poles of different sizes* [1]

CLASS A

Length (feet)	Circumference			Diameter			Volume	Weight [2]
	Top	6 feet from butt	Butt	Top	6 feet from butt	Butt		
	Inches	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Cu. ft.*	*Pounds*
30	24	40	43	7.6	12.7	13.7	20.0	1,100
35	24	43	46	7.6	13.7	14.6	26.0	1,430
40	24	45	48	7.6	14.3	15.3	31.5	1,730
45	24	48	51	7.6	15.3	16.2	39.1	2,150
50	24	51	54	7.6	16.2	17.2	47.5	2,610
55	22	54	58	7.0	17.2	18.5	56.5	3,110
60	22	57	61	7.0	18.1	19.4	67.0	3,680
65	22	60	64	7.0	19.1	20.4	79.4	4,370
70	22	63	67	7.0	20.1	21.3	93.1	5,120
75	22	66	70	7.0	21.0	22.3	107.6	5,920
80	22	70	74	7.0	22.3	23.6	127.4	7,010
85	22	73	78	7.0	23.2	24.8	145.4	8,000
90	22	76	81	7.0	24.2	25.8	165.9	9,120
CLASS B								
30	22	36	38	7.0	11.5	12.1	16.5	910
35	22	40	42	7.0	12.7	13.4	22.2	1,229
40	22	43	46	7.0	13.7	14.6	28.5	1,570
45	22	47	50	7.0	15.0	15.9	36.9	2,030
50	22	50	52	7.0	15.9	16.9	45.0	2,480
55	22	53	57	7.0	16.9	18.1	54.7	3,010
60	22	56	60	7.0	17.8	19.1	65.1	3,580
65	22	59	63	7.0	18.8	20.1	77.2	4,250
70	22	62	67	7.0	19.7	21.3	90.1	4,960
75	22	65	70	7.0	20.7	22.3	104.9	5,770
80	22	69	74	7.0	22.0	23.6	124.6	6,850
85	22	72	78	7.0	22.9	24.8	142.1	7,820
90	22	75	81	7.0	23.9	25.8	162.2	8,920
CLASS C								
30	20	33	35	6.4	10.5	11.1	13.7	750
35	20	36	38	6.4	11.5	12 1.	18.3	1,010
40	20	40	42	6.4	12.7	13.4	24.4	1,340
45	20	43	46	6.4	13.7	14.6	30.9	1,700
50	20	46	49	6.4	14.6	15.6	38.0	2,090
55	20	49	53	6.4	15.6	16.9	46.7	2,570

[1] Sizes conform to standard specifications of the National Electric Light Association.
[2] Based on a weight of 55 pounds per cubic foot.

TABLE 4.—*Weights of chestnut poles during seasoning, expressed in per cent of green weight, for poles cut in the different seasons* [1]

Duration of seasoning (months)	Season when cut				Duration of seasoning (months)	Season when cut			
	Spring	Summer	Fall	Winter		Spring	Summer	Fall	Winter
	Per cent	*Per cent*	*Per cent*	*Per cent*		*Per cent*	*Per cent*	*Per cent*	*Per cent*
0	100	100	100	100	8	82	85	85	82
1	94	93	96	98	9	82	85	84	81
2	90	89	94	95	10	82	84	83	80
3	87	88	93	93	11	82	83	82	79
4	86	87	92	90	12	81	82	81	79
5	85	87	91	88	13	80	81	80	79
6	84	86	89	85	14	80	80	79	78
7	83	86	87	84	15	79	79	79	78

[1] Based on weights reported for 600 poles cut in Thorndale, Pa. (See Forest Service Circular 103, Seasoning of Telephone and Telegraph Poles, p. 11; also, Bulletin 84, Preservative Treatment of Poles, p. 51.)

PILING

The classification or grading of piling depends largely upon its use, whether in fresh water, salt water, or on land, and upon its form and size. Very often the kind of wood is not specified, and the require-

ments refer to straightness, length, and butt diameter measured 3 feet from the end. Specifications are sometimes rather brief and simple, and piling then becomes one of the easiest classes of timber to grade for the market. Important construction work often calls for specifications more or less similar to the following:

All piling shall be cut from sound, live trees of slow growth and firm grain and free from ring heart, wind-shakes, decay, large or unsound knots, or any other defects that will impair their strength or durability. The trees shall be butt-cut above the ground swell, and shall taper uniformly from butt to tip. Piles shall be so straight that the line joining the centers of the ends will fall entirely within the pile, and that in the opinion of the inspector they can be subjected to hard drying without injury. No short or reverse bends will be allowed. Bark shall be peeled from the entire length of all piles, and all knots shall be trimmed close. No pile will be accepted with a top measuring less than 6 inches in diameter. The allowable diameter shall be as follows: Butts of piles under 30 feet in length to be from 12 to 16 inches and butts of piles from 30 to 50 feet in length to be from 12 to 18 inches.

Piling is sold at a stated price per linear foot for specified dimensions and kinds of wood. The price increases rapidly with increase in length and in desirability of form or taper. Handling and transportation costs are large because of the heavy weight of sticks of this size. Table 5 shows the approximate weight of piling of different sizes and of different kinds of wood in both green and dry condition:

TABLE 5.—*Approximate weights of piling of different sizes, green and dry, for different kinds of wood, also weight per cubic foot of each* [1]

Length (feet)	White oak		Black oak		Sugar maple		Cypress	
	Green [2]	Air-dry	Green [2]	Air-dry	Green [2]	Air-dry	Green [2]	Air-dry
	Weight (pounds)							
20	610	470	610	440	550	430	470	290
25	770	590	770	550	690	530	590	370
30	920	700	920	660	820	640	710	440
35	1,080	820	1,080	770	960	750	820	520
40	1,580	1,200	1,590	1,140	1,410	1,100	1,210	760
45	1,780	1,360	1,790	1,280	1,590	1,240	1,370	850
50	1,980	1,500	1,980	1,420	1,770	1,370	1,520	950
	Weights per cubic foot used above (pounds)							
	62.7	45.0	62.5	47.6	55.9	43.4	48.0	30.0

Length (feet)	Chestnut		White elm		Black gum		Longleaf pine		Increase with top diameter of 8 inches (per cent)
	Green	Air-dry	Green	Air-dry	Green	Air-dry	Green	Air-dry	
	Weight (pounds)								
20	540	300	480	340	440	350	490	410	15.3
25	670	370	600	430	550	450	610	510	15.4
30	810	440	710	510	660	530	740	620	15.6
35	940	520	840	600	770	620	860	720	15.7
40	1,390	760	1,230	880	1,130	920	1,260	1,060	12.3
45	1,560	860	1,390	990	1,270	1,030	1,420	1,200	11.9
50	1,730	950	1,540	1,090	1,410	1,140	1,580	1,330	12.3
	Weights per cubic foot used above (pounds)								
	54.8	30.2	48.6	34.6	44.7	36.2	50.0	42.0	

[1] Top diameter, 6 inches; butt diameter, 12 inches for piling 20 to 35 feet, inclusive; 14 inches for piling 40 to 50 feet, inclusive.

[2] The green weight or the weight of wood before it is air-dry varies widely. The weights here given are based upon the weights of logs shipped in by rail to the Forest Products Laboratory, Madison, Wis., for purposes of testing.

CROSSTIES

The specifications for railroad ties in most cases are for sound timber of good quality, stripped of bark, and free from imperfections that would impair their strength and durability, such as shakes and loose or decayed knots. The ties must be sawed or hewed smooth on two parallel faces, and the ends must be cut square. Pole ties are made of round timber on which are hewed two parallel faces (fig. 5); square ties are hewed or sawed into rectangular shape.

Ties are classified according to (1) the species of wood, (2) its wearing and lasting qualities and need for preservative treatment, and (3) the thickness and width of face, or dimensions.

Class U ties consist of the more durable woods and include the heartwood of white oak, black locust, black walnut, catalpa, chestnut, red mulberry, sassafras,

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FIGURE 5.—Crossties are an important farm-timber crop. They are in general demand

redwood, pine, larch, cypress, cedar, and Douglas fir. Class T is made up of the following woods: Ash, hickory, honey locust, red oak, beech, birch, cherry, gum, hard maple, elm, hackberry, sycamore, butternut (white walnut), poplar, soft maple, hemlock, spruce, and the "sap" (or sapwood) of all the woods mentioned above as belonging to class U. Class T are woods which require treatment with some preservative, while class U woods may be used without such special treatment.

Grades 1 to 5, inclusive, standard-gage ties, refer to sizes, the highest grade being the largest in size. For example, grade 1 calls for a round-edge tie, 6 by 6 inches, hewed or sawed top and bottom, while a grade 5 tie is 7 by 9 inches, either sawed square-edged or round-edged, hewed or sawed top and bottom.

Standard-gage railroad ties are either 8, 8½, or 9 feet in length. Narrow-gage ties run from 5 to 7 feet in length.

Because of its very general use by the railroads of the country and the widespread demand for information on the subject, there are given below the specifications as drawn up by the American Standards Association and adopted by all the large associations of producers and users of crossties.

STANDARD SPECIFICATIONS FOR CROSSTIES

Kinds of wood.—Before making ties, producers shall ascertain which of the following kinds of wood suitable for crossties will be accepted: Ash, beech, birch, catalpa, cedar, cherry, chestnut, cypress, Douglas fir, elm, fir (true), gum, hackberry, hemlock, hickory, larch, locust, maple, mulberry, oak, pine, poplar, redwood, sassafras, spruce, sycamore and walnut. Others will not be accepted unless specially ordered.

General quality.—Except as hereinafter provided, all ties shall be free from any defects that may impair their strength or durability as crossties, such as decay,

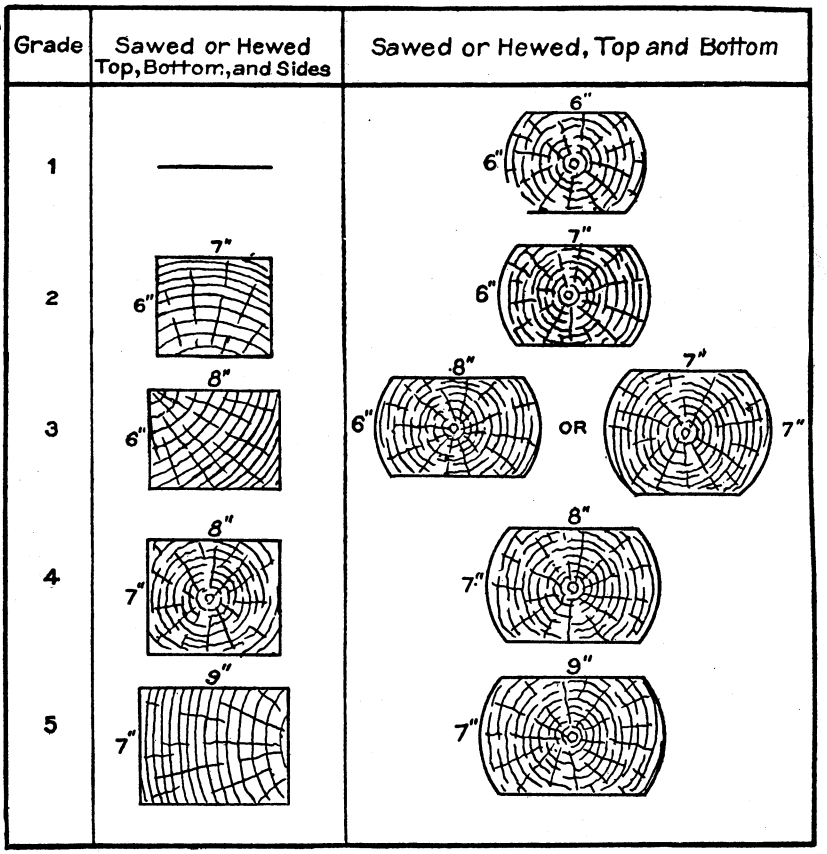

FIGURE 6.—The above are minimum dimensions. Ties over 1 inch more in thickness, over 3 inches more in width, or over 2 inches more in length will be degraded or rejected. The top of the tie is the plane farthest from the pith of the tree, whether or not the pith is present in the tie

large splits, large shakes, large or numerous holes or knots, and grain with slant greater than 1 in 15.

Resistance to wear.—When so ordered, ties from needle-leaved trees shall be of compact wood throughout the top fourth of the tie, where any inch of any radius from the pith shall have six or more rings of annual growth.

Resistance to decay.—Ties for use without preservative treatment shall not have sapwood wider than one-fourth the width of the top between 20 inches and 40 inches from the middle of the tie, and will be designated as "heart" ties. Those with more sapwood will be designated as "sap" ties.

Dimensions.—Before manufacturing ties, producers shall ascertain which of the following lengths, shapes, or sizes will be accepted, and whether ties are to be hewed or sawed and in either case whether on the sides as well as on the top and the bottom.

Except as hereinafter provided, standard-gage railway ties shall be 8, 8½, or 9 feet long; narrow-gage railway ties shall be 5, 5½, 6, 6½, or 7 feet long.

Except as hereinafter provided, ties shall measure as follows throughout both sections between 20 inches and 40 inches from the middle of the tie (fig. 6):

Sawed or hewed top, bottom, and sides

Size	
0	5 inches thick by 5 inches wide on top.
1	6 inches thick by 6 inches wide on top.
2	6 inches thick by 7 inches wide on top.
3	6 inches thick by 8 inches wide on top.
4	7 inches thick by 8 inches wide on top.
5	7 inches thick by 9 inches wide on top.
6	7 inches thick by 10 inches wide on top.

Sawed or hewed top and bottom

Size	
0	5 inches thick by 5 inches wide on top.
1	6 inches thick by 6 inches wide on top.
2	6 inches thick by 7 inches wide on top.
3	6 inches thick by 8 inches wide on top. 7 inches thick by 7 inches wide on top.
4	7 inches thick by 8 inches wide on top.
5	7 inches thick by 9 inches wide on top.
6	7 inches thick by 10 inches wide on top.

Manufacture.—Except as hereinafter provided, all ties shall be straight, well hewed or sawed, cut square at the ends, have bottom and top parallel, and have bark entirely removed.

A tie will be considered straight: (1) When a straight line along the top from the middle of one end to the middle of the other end is entirely within the tie; and (2) when a straight line along a side from the middle of one end to the middle of the other end is everywhere more than 2 inches from the top and the bottom of the tie.

A tie is not well hewed or sawed when its surfaces are cut into with score marks more than one-half inch deep or when its surfaces are not even.

The top and bottom of a tie will be considered parallel if any difference in the thicknesses at the sides or ends does not exceed one-half inch.

Delivery.—Ties delivered on the premises of a railway for inspection shall be stacked not less than 10 feet from the nearest rail of any track at suitable and convenient places; but not at public crossings, nor where they will interfere with the view of trainmen or of people approaching the railway. Ties shall be stacked in alternate layers of 2 and 7, the bottom layer to consist of 2 ties kept at least 6 inches above the ground. The next layer shall consist of 7 ties laid crosswise of the first layer. When the ties are rectangular, the 2 outside ties of the layers of 7 and the layers of 2 shall be laid on their sides. The ties in layers of 2 shall be laid at the extremes ends of the tie in the layers of 7. No stack may be more than 12 layers high, and there shall be 5 feet between stacks to facilitate inspection. Ties which have stood on their ends on the ground will be rejected.

Each stack shall have fastened to it a tag on which is written the owner's name and address, the date when stacked, and the number of ties of each kind of wood in the stack.

All ties are at the owner's risk until accepted. All rejected ties shall be removed within one month after inspection.

Ties shall be stacked as grouped below. Only the kinds of wood named in a group may be stacked together.

CLASS U.—TIES WHICH MAY BE USED UNTREATED

Group Ua	Group Ub	Group Cc	Group Ud
"Heart" black locust.	"Heart" Douglas fir.	"Heart" cedars.	"Heart" catalpas.
"Heart" white oaks.	"Heart" pines.	"Heart" cypresses.	"Heart" chestnut.
"Heart" black walnut.	"Heart" larches.	"Heart" redwood.	"Heart" sassafras.
			"Heart" red mulberry.

CLASS T.—TIES WHICH SHOULD BE TREATED

Group Ta	Group Tb	Group Te	Group Td
Ashes.	"Sap" cedars.	Beech.	"Sap" catalpas.
Hickories.	"Sap" cypresses.	Birches.	"Sap" chestnut.
"Sap" black locust.	"Sap" Douglas fir.	Cherries.	Elms.
Honey locust.	Firs (True).	Gums.	Hackberries.
Red oaks.	Hemlocks.	Hard maples.	Soft maples.
"Sap" white oaks.	"Sap" larches.		"Sap" mulberries.
"Sap" black walnut.	"Sap" pines.		Poplars.
	"Sap" redwood.		"Sap" sassafras.
	Spruces.		Sycamores.
			White walnut.

Shipment.—Ties forwarded in cars or vessels shall be separated therein according to the above groups, and also according to the above sizes if inspected before loading, or as may be stipulated in the contract or order for them.

Prices are exceedingly variable in different parts of the country, depending upon the kind of wood, class, grade, and distance of the producing point from the larger trunkline railroads. The difference in price between each of the five grades averages approximately from 10 to 15 cents, and the total range in value runs generally from about 15 cents for No. 1 up to $1 each for the No. 5 ties.

MINE TIMBERS

The kinds and forms of timbers in demand for mines are many, and, as a rule, many kinds of wood are usable. The principal forms of round or rough material, other than lumber, follow:

Mines props are round timbers used as main supports for the roofs and sides of tunnels; in diameter they vary from 4 to 14 inches, and in length mostly from 3 to 12 feet.

Lagging is round timber about 3 inches in diameter and 7 feet in length, used to fill in behind the props and caps to form the sides and roofing of the tunnels. Bars are extra long lagging.

Caps are hewed or sawed pieces of timber of different sizes laid across the tops of pairs of props as a support for the roof lagging, which runs lengthwise of the tunnel.

Sills as foundation for props are from 8 to 14 inches in diameter. Although these are often of sawed material, square hewed timbers are much used.

Mine ties, including tramroad, motor, and heading ties, are ordinary track ties, 4 inches on the face and varying in length mostly from 3 to 5 feet.

Rough lumber goes into mine rails, collar timbers, brattice or partition boards, stringers, and sills.

CORDWOOD

Any kind of wood measured by the cord and in the form of either round or split sticks is called cordwood. Firewood is measured in standard cords, mostly of 4-foot lengths,[4] or short cords of stove wood and other material varying from 12 to 20 inches in length. Wood for distillation, extract wood, excelsior, pulp wood, (fig. 7) handles, cooperage, and woodenware is frequently sold by the rick or cord. The lengths vary mostly from 22 inches for heading to 5 feet for extract and handle stock. Specifications, if given, refer to the kind of wood, length, average size of the pieces, whether split or round, general soundness, body or limbwood, and degree of dryness.

[4] For size and contents of standard cord, see p. 35.

LUMBER

Specifications for the grading of lumber deal with quality and size, in addition to kind of wood. Wood-manufacturing concerns buy their rough stock lumber mostly by grade and dimension where formerly they took the "mill-run" product, or the lumber as it came from the saw without sorting and classifying. It is not the purpose of this bulletin to take in up detail the subject of grading, because it is rather complicated. The basis for grading is the quality of the lumber as determined by the number and size of standard defects, such as knots, shake, wormholes, dote, and stain; also by the width of the piece. In the operation of small portable sawmills, four grades of rough lumber are sometimes recognized, as follows: First and seconds, a general term for the highest grade; No. 1 common; No. 2

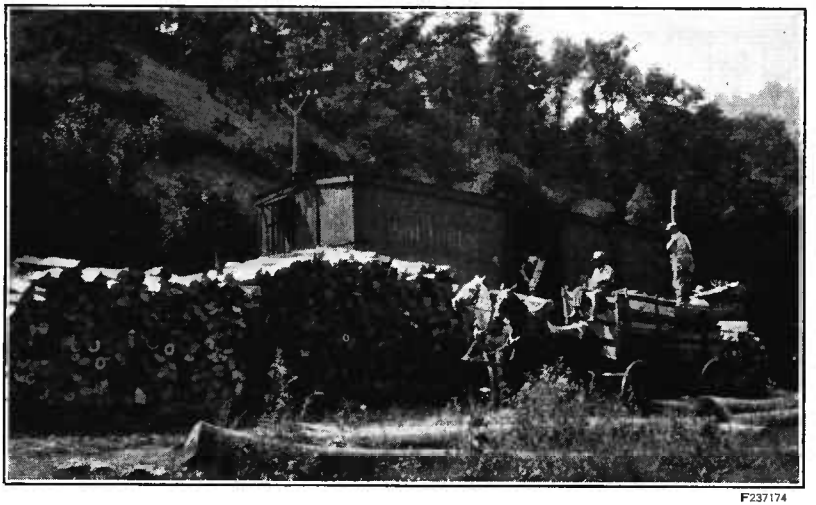

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FIGURE 7.—Large quantities of pulpwood from many kinds of trees are cut and sold from the farm woods

common; and No. 3 common, or culls. In standard mill practice the number of grades greatly increases up to some 9 or 10 for both hardwoods and softwoods. The term "hardwoods" is used to refer to such woods as oaks, ashes, poplars, maples, and all other of the broadleaf trees. The so-called "softwoods" include the cone-bearing trees, or conifers, such as pines, spruces, cypress, cedars, and redwood. In the lumber market grades have been more or less standardized for each species by the various manufacturing associations. Information on the grading of lumber will be furnished upon application to the Forest Laboratory, Madison, Wis.

UNITS USED IN THE MEASUREMENT OF TIMBER

The woodland owner should be familiar with the various units of measure used in the sale of wood, so that he may be able to make an estimate of his standing trees and to measure or scale the timber after it is cut. In regard to his ordinary field crops he is well informed. He knows that hay is sold by the ton, and he can estimate

how many tons the grass on a certain field will produce; or, if he has the hay in a barn, he can calculate how many tons there are in a mow of a certain size. He can estimate the amount of his corn or wheat in a similar manner, because he deals with these crops every year. It is natural that the farmer, not being so familiar with timber measurements as he is with those relating to other crops, should rely on the estimates of the buyer, who, obviously, is careful to see that his own interests are protected. What the farmer needs, then, is a guide to which he can refer when he is considering selling some of the products of his woodland.

Wood is sold in a number of different units. The amount may be measured in board feet, in cords, or it may be sold by the piece in the form of ties, poles, posts, or other products. In the latter case it is comparatively easy to determine, if one has the specifications, just which pieces of wood fulfill the requirements; but when logs are sold in the round it is not easy to determine how many board feet are contained in each log.

To enable one to estimate the number of board feet in logs of different sizes log rules are used. A log rule is a statement, either in the form of a printed table or marked upon a measuring stick, of the estimated number of board feet of lumber which can be sawed from logs of various lengths and diameters. There are over 40 different log rules in use, and the values assigned to logs of the same size by different rules vary considerably. In some States one rule has been made the legal rule and must be used when no log rule is specified in contracts for selling logs, although if buyer and seller can agree to use a different rule no objection is made. In other States, however, it is illegal to use any other rule than the statute rule.

The number of board feet in a log 12 inches in diameter by 16 feet in length, scaled by the different rules, ranges from 62 to 112 board feet. This is a large variation. If the seller had the choice of a rule for measuring logs of this size, he would naturally select the one which gave a large value; and the buyer would, of course, prefer the rule which gave a small value.

TABLE 6.—*International log rule*

[The contents of logs in board feet, by using a circular saw, cutting one-fourth inch kerf, and sawing carefully by good methods]

Diameter of log at small end and inside bark (inches)	Length of log in feet—												
	8	9	10	11	12	13	14	15	16	17	18	19	20
4	2	2	3	3	4	5	5	5	6	7	7	8	9
5	4	5	6	7	7	8	9	11	12	13	15	16	17
6	7	9	10	11	13	14	16	18	19	21	23	25	27
7	12	14	15	17	19	21	24	26	28	31	34	36	39
8	16	19	21	24	27	30	33	36	39	42	46	49	52
9	23	26	29	33	36	40	43	47	51	55	59	63	68
10	29	33	37	42	45	51	54	59	64	69	75	82	89
11	36	42	46	52	57	63	68	74	80	86	95	100	107
12	44	51	57	62	70	77	83	91	97	103	111	119	129
13	52	60	68	76	83	92	100	108	116	124	134	143	151
14	62	71	80	98	107	107	117	127	136	147	158	168	176
15	73	82	94	104	114	125	136	146	157	170	181	195	204
16	84	96	108	119	131	144	156	167	181	194	207	222	233
17	96	110	123	136	149	163	177	192	205	221	235	251	265
18	110	124	139	155	169	185	201	218	232	250	267	282	300
19	123	140	156	175	190	210	225	244	261	280	299	317	337
20	138	157	174	197	212	232	251	270	290	310	330	352	374

TABLE 6—*International log rule*—Continued

Diameter of log at small end and inside bark (inches)	Length of log in feet—												
	8	9	10	11	12	13	14	15	16	17	18	19	20
21	152	172	193	215	234	256	279	299	321	344	366	389	412
22	168	192	214	238	259	282	307	330	354	379	404	429	453
23	186	212	235	260	285	310	337	362	388	415	445	470	498
24	203	232	257	285	311	339	367	398	424	452	484	514	543
25	223	253	281	311	339	370	400	433	462	494	526	560	590
26	241	273	304	337	368	402	435	468	502	537	570	606	640
27	262	296	329	364	400	434	471	504	543	580	617	657	692
28	281	219	356	395	432	470	509	545	586	623	664	706	748
29	303	344	383	425	463	505	546	587	630	670	712	756	801
30	326	369	411	455	498	542	586	628	674	719	765	810	858
31	348	397	442	488	532	582	628	670	724	771	819	868	918
32	373	424	471	520	570	621	672	718	773	821	874	927	979
33	397	452	503	557	608	662	715	766	822	877	929	988	1,042
34	423	481	534	592	647	702	760	718	876	932	990	1,052	1,109
35	450	509	567	627	685	747	805	872	930	992	1,050	1,117	1,176
36	477	540	599	662	727	790	853	920	984	1,052	1,114	1,184	1,244
37	503	570	635	702	767	835	906	974	1,042	1,109	1,178	1,251	1,317
38	532	603	672	742	811	880	954	1,028	1,098	1,174	1,245	1,320	1,388
39	561	635	710	783	858	932	1,004	1,082	1,158	1,237	1,312	1,289	1,467
40	594	671	749	823	902	983	1,059	1,139	1,126	1,300	1,381	1,462	1,543

It is very important to consider what log rule is to be used, because much depends upon it in measuring and selling timber. There is a great difference in both the amount of timber and the resulting money return.

The Doyle rule, in many sections the standard and in some States the legal rule, is unfair to the seller for measuring logs below 28 inches in diameter. In the early days of large cheap timber it was fairly satisfactory, but for small-sized timber it gives such low values as to make it unsatisfactory. The Scribner rule is fairer than the Doyle. Careful sawing, however, should result in 10 to 20 per cent more lumber from second-growth timber than is credited by the Scribner rule.

The international rule (Table 6) gives log volumes that are close to what can be sawed out by using good methods. Owners of small logs for sale will benefit when this or some equally close rule has come into general use.

As a comparison, a log measuring 10 inches in diameter inside the bark at the small end and 16 feet in length would scale by the international rule 64 board feet, which is approximately the amount of lumber that could be sawed from it with a circular saw of ordinary thickness (one-fourth-inch kerf). The same log scaled by the Doyle rule shows 36 board feet, or only about one-half the amount that can be actually sawed.

TABLE 7.—*Comparison of log rules*

[The values given are for 16-foot logs only]

Top diameter of log inside bark (inches)	Contents of log in board feet by rule stated—												
	International	Scribner		Doyle	Doyle and Scribner	Holland or Maine	Blodgett or New Hampshire	Humphrey or Vermont	Bangor	Cumberland River	Square of three-fourths	Herring	Champlain
		Scribner	Decimal C.										
4	6	(10)	(10)	------	------	(3)	13	11	(6)	8	12	(6)	8
5	12	(13)	(10)	1	1	(11)	19	16	(12)	12	19	(12)	14
6	19	18	20	4	4	20	26	24	23	17	27	(19)	22
7	28	24	30	9	9	31	35	32	27	23	37	(26)	32
8	39	32	30	16	16	44	43	43	41	31	48	34	43
9	51	42	40	25	25	52	54	53	54	39	61	43	56
10	64	54	60	36	36	68	66	67	69	47	75	53	70
11	80	64	70	49	49	83	78	80	84	57	91	65	87
12	97	79	80	64	64	105	92	96	100	68	108	77	105
13	116	97	100	81	81	120	106	112	118	80	127	91	124
14	136	114	110	100	100	142	123	131	137	93	147	107	146
15	157	142	140	121	121	161	139	149	158	107	169	124	168
16	181	159	160	144	144	179	157	171	182	121	192	142	193
17	205	185	180	169	169	205	176	192	209	137	217	162	219
18	232	213	210	196	196	232	197	216	238	153	243	183	247
19	261	240	240	225	225	271	217	240	268	171	271	206	277
20	290	280	280	256	256	302	240	267	300	190	300	230	308
21	321	304	300	289	289	336	262	293	334	209	331	256	341
22	354	334	330	324	324	363	287	323	369	229	365	284	376
23	388	377	380	361	361	401	313	352	406	250	397	313	412
24	424	404	400	400	400	439	339	384	444	273	432	344	450
25	462	459	460	441	441	477	367	416	484	296	469	377	490
26	502	500	500	484	484	507	397	451	526	320	507	411	532
27	543	548	550	529	529	546	426	485	566	345	547	447	575
28	586	582	580	576	582	614	457	523	609	372	588	485	620
29	630	609	610	625	609	657	489	560	652	399	631	525	666
30	674	657	660	676	657	706	514	600	697	427	675	567	714
31	724	710	710	729	710	755	557	640	743	456	721	616	764
32	773	736	740	784	736	795	592	683	792	485	768	655	814
33	822	784	780	841	784	848	628	725	842	516	817	703	868
34	876	800	800	900	800	900	666	771	892	548	867	752	923
35	930	876	880	961	876	949	704	816	(950)	581	919	(800)	980
36	984	923	920	1, 024	923	1, 026	744	864	(1, 000)	614	972	(850)	1, 038
37	1, 042	1, 029	1, 030	1, 089	1, 029	1, 089	785	912	(1, 050)	649	1, 027	(910)	1, 097
38	1, 098	1, 068	1, 070	1, 156	1, 068	1, 135	827	963	(1, 110)	685	1, 083	(960)	1, 159
39	1, 158	1, 120	1, 120	1, 225	1, 120	1, 209	870	1, 013	(1, 170)	721	1, 141	(1, 020)	1, 222
40	1, 216	1, 204	1, 200	1, 296	1, 204	1, 261	914	1, 067	(1, 220)	759	1, 200	(1, 080)	1, 287

TABLE 8.—*Doyle log rule*

Diameter of log small end, inside bark (inches)	Length of log in feet												
	6	7	8	9	10	11	12	13	14	15	16	17	18
	Contents of log in board feet												
6	1	2	2	2	2	3	3	3	3	4	4	4	4
7	3	4	4	5	5	6	7	7	8	8	9	10	10
8	6	7	8	9	10	11	12	13	14	15	16	17	18
9	9	11	12	14	16	17	19	20	22	23	25	27	28
10	13	16	18	20	22	25	27	29	31	34	36	38	40
11	18	21	24	28	31	34	37	40	43	46	49	52	55
12	24	28	32	36	40	44	48	52	56	60	64	68	72
13	30	35	40	46	51	56	61	66	71	76	81	86	91
14	37	44	50	56	62	69	75	81	87	94	100	106	112
15	45	53	60	68	76	83	91	98	106	113	121	129	136
16	54	63	72	81	90	99	108	117	126	135	144	153	162
17	63	74	84	95	106	116	127	137	148	158	169	180	190
18	73	86	98	110	122	135	147	159	171	184	196	208	220
19	84	98	112	127	141	155	169	183	197	211	225	239	253
20	96	112	128	144	160	176	192	208	224	240	256	272	288
21	108	126	144	163	181	199	217	235	253	271	289	307	325
22	121	142	162	182	202	223	243	263	283	304	324	344	364

TABLE 8.—*Doyle log rule*—Continued

Diameter of log small end, inside bark (inches)	Length of log in feet												
	6	7	8	9	10	11	12	13	14	15	16	17	18
	Contents of log in board feet												
23	135	158	180	303	226	248	271	293	316	338	361	384	406
24	150	175	200	225	250	275	300	325	350	375	400	425	450
25	165	193	220	248	276	303	331	358	386	413	441	469	496
26	181	212	242	272	302	333	363	393	423	454	484	514	544
27	198	231	264	298	331	364	397	430	463	496	529	562	595
28	216	252	288	324	360	396	432	468	504	540	576	612	648
29	234	273	312	352	391	430	469	508	547	586	625	664	702
30	253	296	338	380	422	465	507	549	591	634	676	718	760
31	273	319	364	410	456	501	547	592	638	683	729	775	820
32	294	343	392	441	490	539	588	636	686	735	784	833	882
33	315	368	420	473	526	578	631	683	736	788	841	894	946
34	337	394	450	506	562	619	675	731	787	844	900	956	1,012
35	360	420	480	541	601	661	721	781	841	901	961	1,021	1,081
36	384	448	512	576	640	704	768.	832	896	960	1,024	1,088	1,152
37	408	476	544	613	681	749	817	885	953	1,021	1,089	1,157	1,225
38	433	506	578	650	722	795	867	939	1,011	1,084	1,156	1,228	1,300
39	459	536	612	689	766	842	919	995	1,072	1,148	1,225	1,302	1,378
40	486	567	648	729	810	891	972	1,053	1,134	1,215	1,296	1,377	1,458

To find the number of board feet in a log according to the Doyle rule: Deduct 4 from the diameter (in inches) of the small end and square the remainder. This gives the contents of a 16-foot log in board feet. The number of board feet in logs of other lengths is in proportion to their lengths; for example, an 8-foot log contains half as many board feet as a 16-foot log, and so on.

The above figures were obtained in this manner.

SCALING TIMBER

BOARD FEET

Log lengths can be conveniently measured with a measuring stick 8 feet long. About 3 inches should be added to the nominal length of the log, so that the rough ends may be trimmed at the mill. If more than 6 inches of extra length is left, however, carelessness in sawing the tree into logs is indicated. For scaling purposes the average diameter inside bark at the small end of the log is measured. Several diameters may be measured where necessary to obtain a fair average. (Fig. 8.) Diameters are rounded off to the nearest inch; that is, 7¼ would be considered 7, 7¾ would be considered 8, and 7½ should be roughly divided equally between the 7-inch and 8-inch diameters.

As soon as each log is scaled it should be marked with crayon, so that there will be no danger of scaling it again. If systematic scaling is to be done, it is desirable to use a special book for the purpose. Number each log in this case instead of marking it with a cross or other mark. When the log is scaled its number is written on the small end.

The scale book should be ruled off into groups of four columns, the first column for the number of the log, the second for its length, the third for its diameter, and the fourth for the number of board feet. Only one kind of timber should be entered on a page.

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FIGURE 8.—Scaling the amount of saw timber in a log by the use of a log scale stick

Form for ruling log scale book

Log No.	Length	Diameter	Scale	Log No.	Length	Diameter	Scale
	Feet	*Inches*	*Bd. ft.*		*Feet*	*Inches*	*Bd. ft.*
1				10			
2				11			
3				12			
4				13			
5				14			
6				15			
7				16			
8				17			
9				Etc.			

In case no scale stick is available the logs can be measured with an ordinary rule or yardstick and the board-foot values entered later with the use of a log-scale table. If the farmer expects to do much scaling he should provide himself with a log-scale stick. This consists of a strip of hickory about a quarter of an inch thick, 1½ inches wide, and long enough to measure the largest logs which he will have to scale. It has marked on it the estimated board-foot contents of logs of different lengths and diameters. The contents of the logs can be read directly from the stick. Scale sticks are made to show the values by one, or sometimes two log rules. As an aid in securing standard log scale sticks, see "Estimating by timber scaling sticks," on page 22.

The scaling of sound logs is a comparatively simple matter. Deductions should be made for defects in logs. How to estimate such losses can be learned from men of experience or by watching the sawing of logs.

LINEAR FEET

Some forest products, such as piles and mining timbers, are sold by the linear foot. This simply means that timbers of certain diameters are sold for special purposes, the price depending on the number of linear feet in the stick or the total length of the stick. In this case it is only necessary to make sure that the diameters are those demanded by the specifications and that the lengths are measured accurately. If it is desirable to keep a record of posts scaled by this method, they can be entered in a scaling book and given a number or not as the scaler may think necessary.

BY THE PIECE

Railroad ties, posts, and some other products are usually sold by the piece. Certain maximum and minimum specifications or sizes are usually given, and then the sticks that come within these sizes are counted. These can be kept track of by numbering, or marking, with a crayon one end of each tie as it is counted.

CORDWOOD

Most farmers are familier with the measurement of cordwood, but one or two points may be mentioned in this connection. It is customary to pile green cordwood 2 or 3 inches higher than the required 4 feet, in order to allow for shrinkage and settling as the wood dries. The average height and the average length of the pile should be measured in finding the number of cords.

The standard cord is 8 feet long 4 feet wide and 4 feet high. In some localities a long cord, 8 feet by 5 by 4 feet, is used. Again, it often happens that sticks 4 feet long are sawed into 16-inch sticks and split fine enough for stove fuel. A running cord of this short wood, that is, a pile 8 feet long 4 feet high and 16 inches wide, equals one-third of a standard cord.

ESTIMATING STANDING TIMBER

The timber on a tract can be estimated fairly accurately with no other equipment than a tape, stick, or calipers for measuring diameters, and a log scale. The contents of each log in each tree is estimated separately and the amounts summed up for each kind or

species of tree. Other methods are the use of a tree-scaling or cruising stick showing directly how much timber is contained in trees of different sizes of a given species, and the use of volume tables, such for example as Tables 10 and 11. Unless the tract is very large it is desirable to estimate every tree, rather than the trees on sample portions of the tract.

ESTIMATING BY TIMBER-SCALING STICKS

For estimating the contents of standing trees, various kinds of tree-scale sticks, or "cruising" sticks, are coming into popular use.

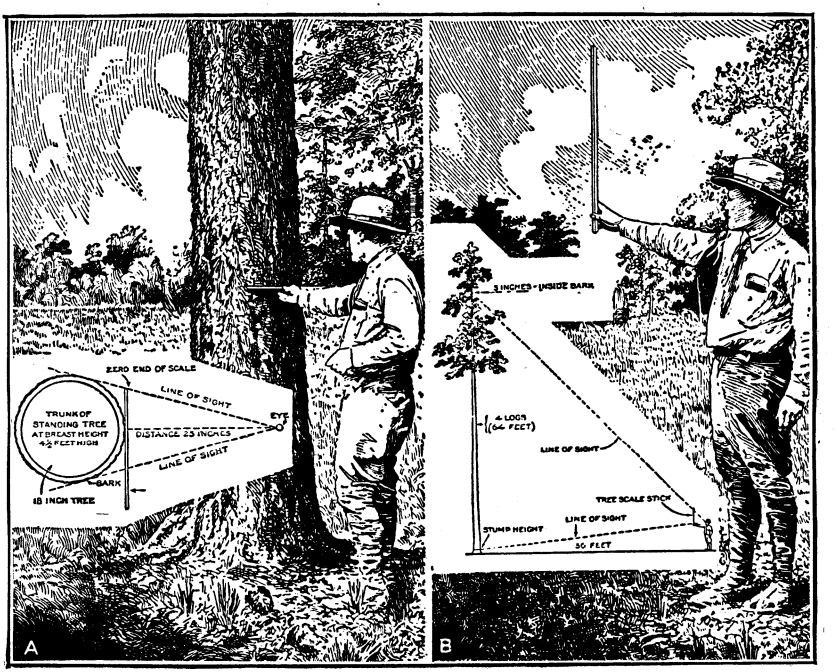

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FIGURE 9.—Estimating the saw timber in a pine tree by the use of a tree scale, or cruiser's stick: A, If the stick is held horizontally against the trunk of the tree at a specified distance from the eye, the observer is able to read directly the diameter of the tree outside the bark. The standard is called the breast-high diameter, and is taken at a height of 4½ feet above the average level of the ground. B, The stick is graduated so that, when held a specified distance from the eye of the observer who stands a specified distance from the tree, the observer can read the number of 16-foot-log lengths in the tree. The principle is that of two similar triangles

They are used to measure the diameter and the height, or the number of logs, in a tree. One is known as the Biltmore stick. Sticks of another and more useful class also show for trees of different diameters and number of 16-foot cuts, the number of board feet of saw timber that can be cut out.

A handy set of sticks for measuring and estimating the contents of logs and of standing trees (fig. 9) consisting of a log-scale stick and a tree-scale stick, based upon the international rule, is distributed at cost by the Federal Land Bank of Springfield, Mass. The tree-scale stick is applicable to white pine, spruce, hemlock, white and red oaks, and other important timber trees. A similar set of log-scale and tree-

scale sticks, applicable particularly to the four important kinds of southern pines is also distributed at cost as an educational feature, by the American Forestry Association, Washington, D. C. In using the tree-scale stick of the latter set, it should be noted that the amounts or scale of saw timber shown for shortleaf pine, also hold approximately good for longleaf pine trees, and those shown for loblolly pines are likewise good for slash pine trees.

ESTIMATING WITHOUT VOLUME TABLES

In case a person has no tree-scale stick or other form of volume table, showing the board feet in trees of different sizes, it is possible to estimate standing timber fairly accurately by the use of some kind of a measure for finding the diameters of trees and of a log scale. (Tables 6 or 8.)

A notebook or sheet of paper should be ruled off in squares of a convenient size somewhat as shown in the sample diagram below.

Species	Butt log			Second log			Third log			Total scale
	Length	Diameter	Scale	Length	Diameter	Scale	Length	Diameter	Scale	
	Feet	*Inches*	*Bd. ft.*	*Feet*	*Inches*	*Bd. ft.*	*Feet*	*Inches*	*Bd. ft.*	*Bd. ft.*
White oak	16	16		16	14		16	11		
Red oak	12	10		12	8					
Sugar maple	14	15		12	12					
Beech	16	18		16	16		14	13		
(Etc.)										

The estimator looks over the first tree and makes an estimate of the number of logs that can be cut out of it. (Figs. 10 and 11.) Suppose the first tree is a white oak which forks at about 50 feet from the ground. Above that point the branches are too small or too crooked to be used for saw logs. Allowing for the stump, then the merchantable length of the tree is 48 feet, or three 16-foot logs. By looking at the tree carefully the estimator decides that the diameter, inside the bark, at the top of the first 16-foot log is 16 inches. Sixteen feet farther up the diameter appears to be 2 inches less, while at the top of the third log the diameter is 11 inches. These figures are entered in the proper spaces as shown in the diagram; and, later on, the number of board feet in each of the three logs can be determined with the aid of the log rule (Tables 6 or 8), and the total board-foot contents of the tree found by adding the results.

In some cases it may be desirable to indicate the grade of each log in the tree. The butt logs are generally of the highest grade and the top logs of the lowest. Where higher prices are paid for No. 1 logs, the difierence may be enough to make it worth while to separate them from the No. 2 or No. 3 logs. The grade of the logs can be indicated in the upper right-hand corner of the square which is left

for the board-foot contents of the log. When the final figures are added up only those which have a "1" in the upper right-hand corner will be added together to get the total amount of No. 1 logs; then are added the values which are indicated by No. 2, and so on.

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FIGURE 10.—Measuring the contents of standing timber and marking trees to be cut in a sale. Marking is done by the use of white paint or by blazing the bark. The presence of foliage helps in making a right selection of trees

When each tree is estimated, it should be marked in some way, so that there will be no danger of its being measured again. A piece of chalk or whitewash may be used or a small bark blaze can be made with a hatchet. This procedure is continued, the trees being taken as they come, but only those estimated which are big enough to be merchantable.

It is advisable to estimate the trees on an area of fairly uniform width, continuing across the tract until the other side is reached, then on the return trip the estimator can proceed on a fairly straight line. This makes it possible to be sure of getting all the trees without

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FIGURE 11.—Second-growth pine leads all other kinds of timber in the South for ready market. Timber is wanted for lumber, excelsior, crossties, pulpwood, and firewood

having to cover too much ground. The width of the first strip on which the timber is estimated will depend upon the convenience of the operator. With open timber the width can be greater than where the trees stand close together or where there is much underbrush. Under average conditions 50 feet would be a good width for the strip.

This method can also be used in estimating posts or poles or even cordwood. If posts are to be estimated, the species or kind of wood, the length, and the top diameter of each are recorded. If the facts are put down in this form, the value of all the posts, or of any particular class, may be easily calculated. Table 9 will be useful in estimating roughly the quantity of material in cords, ties, poles, or saw logs contained in trees of different diameters.

TABLE 9.—*Quantity of material contained in trees of different sizes* [1]

Diameter of tree, breast-high (inches)	Number of trees of each size required to yield—						Tie and pole product per tree	
	1 cord			1,000 feet of lumber				
	Hardwoods		Softwoods	Hardwoods		Softwoods	Number of ties, hardwoods [4]	Length of pole, hardwoods [5] (feet)
	Northern	Southern		Northern [2]	Southern [3]			
2		170						
3		90						
4		50						
5	35	25						
6	20	17						
7	15	13	20					
8	11	9	13			25		
9	8	7	10	85	66	20		
10	6	6	8	45	33	15	1	
11	5	5	7	28	22	10	1	
12	4	4	6	19	13	8	2	25
13	3.5	3.4	4.5	14	11	7	2	25
14	3.0	3.0	3.7	11	9	6	3.3	30
15	2.5	2.5	3.0	8	7	5	3.3	35
16	2.0	2.2	2.5	7	6	4		40
17	1.7	2.0	2.1	6	5	3.1		40
18	1.5	1.8	1.9	5	4.5	2.6		45
19	1.3	1.5	1.6	4	4.0	2.4		45
20	1.2	1.3	1.5	3.5	3.3	2.1		45
21	1.0	1.2	1.4	3.1	3.0	1.8		50
22	.9	1.1	1.2	2.7	2.7	1.7		55
23	.8	1.0	1.1	2.3	2.5	1.6		55
24	.7	.9	1.0	2.0	2.2	1.5		55

[1] From Bulletin 9, State of New York Conservation Commission (adapted in tie and pole production).
[2] For every thousand feet of lumber about two-thirds of a cord of wood can also be cut from the tops.
[3] For every thousand feet of lumber about three-quarters of a cord of wood can also be cut from the tops.
[4] For every 10 ties about 1 cord of wood can also be cut from the tops.
[5] For every 10 poles about 1 cord of wood may also be cut from the tops.

NOTE.—Softwoods taken to 4 inches top diameter. Northern hardwoods: Beech, birch, and maple to 4 inches top diameter. Southern hardwoods: Chestnut, oak, hickory, basswood, ash, etc., to 3 inches top diameter.

ESTIMATING WITH VOLUME TABLES

A volume table gives the same information about a whole tree that a log rule gives about a log; that is, the average number of board feet which a tree of any given size is estimated to contain.

Such tables are made by scaling a large number of trees and finding the number of board feet in each, then grouping those of the same size together and averaging them. The table gives the average number of board feet in trees of the sizes measured. Trees differ in shape, and even those of the same height and diameter will vary a good deal in contents, but when many trees are measured the averages are fairly dependable. A volume table which would give an accurate total if applied to all the trees on a tract might show a result containing an error of from 25 to 50 per cent if applied to only one or two trees.

Since different kinds of trees differ from each other in form, the volume table made for one species does not necessarily apply accurately to another. There is not so much difference between the individual hardwoods or individual softwoods as between hardwoods and softwoods. Table 12 is to be used as a general volume table for hardwoods (broadleaf) and Table 13 for softwoods (conifers). Certain factors are given by which correction can be made so as to produce accurate results for different kinds of trees; for example, the hardwoods table applies to red oak without correction, but for white oak 10 per cent must be added when the trees are over 16 inches in diameter.

Estimating the timber on a tract by means of volume tables is not so accurate as estimating each log in each tree separately; but it can be done much more quickly and is accurate enough under ordinary circumstances.

The trees are tallied in a different manner from that indicated where volume tables are not used. If the table is made to show the volumes of trees of various diameters and log lengths, a tally sheet must be prepared so that the trees may be tallied in the same units. A sheet of this kind, which can be ruled on paper, is shown below. The kinds of trees for which different stumpage prices are paid should be kept separately in order that the correct values can be calculated.

Sample tally sheet for tallying trees when volume tables are available

ACRE NO. --------

Diameter of tree breast-high (inches)	White oak			Black oak			Tulip poplar			Hickory			Chestnut			Etc.					
	1-log	2-log	3-log	1-log	2-log	3-log	1-log	2-log	3-log	1-log	2-log	3-log	1-log	2-log	3-log	1-log	2-log	3-log	1-log	2-log	3-log
8																					
10																					
12																					
14																					
16																					
18																					
20																					
22																					

TABLE 10.—*Amount of saw timber in hardwood trees of different diameters and merchantable heights*

[Stump height, 2 feet. Trees over 75 years old. Scribner decimal C rule [1]]

Diameter of tree, breast-high (inches)	Number of 16-foot logs									Diameter of top (inside bark)	Basis
	1	1½	2	2½	3	3½	4	4½	5		
	Volume—board feet										
										Inches	*Trees*
9	20	27	35	43						6	
8	20	32	42	53						3	1
10	20	36	52	64	81					6	2
11	21	43	62	78	98	120				6	4
12	23	50	73	93	120	140	180			6	3
13	25	58	86	110	140	170	200			7	4
14	27	67	100	130	160	190	230	260		7	9
15	30	77	120	150	180	220	260	300		8	15
16	34	89	130	170	200	250	290	340	390	8	18
17	38	100	150	190	230	280	320	380	440	9	40
18	43	120	170	210	260	310	360	420	490	9	56
19	48	130	200	240	290	350	400	470	540	10	65
20	54	150	220	270	330	390	450	520	590	10	75
21	62	170	250	300	370	440	500	580	650	11	86
22	69	190	270	340	410	480	550	640	720	11	90
23	77	210	300	380	450	530	610	700	790	12	67
24	85	230	340	420	500	580	670	770	860	12	80
25	93	250	370	460	550	640	740	840	940	13	56
26	100	280	410	510	600	700	810	910	1,020	13	89
27	110	300	450	560	660	770	880	990	1,110	14	68
28	120	330	490	610	720	830	960	1,080	1,200	14	81
29	130	360	530	660	780	900	1,030	1,160	1,300	15	61
30	140	390	580	720	850	980	1,120	1,250	1,400	15	47
31		420	630	770	910	1,050	1,200	1,350	1,510	16	45
32		450	690	830	980	1,130	1,290	1,450	1,620	16	40
33		480	740	890	1,050	1,211	1,380	1,560	1,730	17	49
34			800	950	1,120	1,290	1,480	1,670	1,860	17	30
35			860	1,010	1,180	1,380	1,570	1,790	1,990	18	22
36			920	1,070	1,250	1,460	1,680	1,910	2,140	18	17
37				1,130	1,320	1,550	1,780	2,040	2,290	19	24
38				1,190	1,390	1,640	1,890	2,170	2,450	19	11
39				1,250	1,460	1,730	2,000	2,300	2,600	20	16
40				1,310	1,540	1,820	2,120	2,430	2,760	20	15
41					1,610	1,910	2,240	2,570	2,930	21	6
42					1,680	2,000	2,360	2,720	3,100	21	3
43					1,750	2,090	2,470	2,860	3,270	22	3
44					1,830	2,180	2,590	3,010	3,450	22	2
											1,300

[1] Gives volumes of trees about as sawed out in average practice.

Correction factors for different species

Chestnut, for diameters from 8 to 40 inches, subtract 10 per cent.
Chestnut oak, for diameters from 32 to 40 inches, add 10 per cent.
White oak, for diameters from 18 to 40 inches, add 10 per cent.
Other common hardwoods, for all diameters, use the table without change.

It will be noticed that the volume tables which are based on diameter and number of logs (merchantable lengths) use a 16-foot log as a standard, but that additional columns showing half-logs are given. In estimating any individual tree, the number of logs and half-logs contained in it is estimated and indicated on the tally sheet.

A 16-inch, 2-log tree would be tallied by putting a dot in the square opposite 16 inches and in the column headed 2. The trees may be tallied by fives; that is, four parallel marks and a fifth one across the first four, thus: 𝍸; but unless this method is preferred trees should be tallied in tens, because by this method more trees

can be shown on the same amount of space. The first four trees are indicated by dots and the next six by connecting lines. Each complete square with its diagonals indicates 10 trees. The different stages by which the tally is built up are shown below.

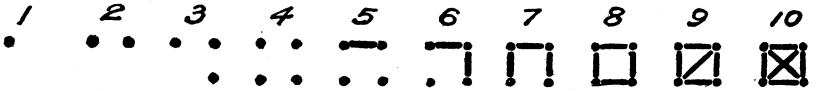


TABLE 11.—*Amount of saw timber in softwood trees (pines, spruces, etc.) of different diameters and merchantable heights*

[Stump height, 2 feet. Diameter (inside bark) of top, 6 inches. Trees over 75 years old. Scribner decimal C rule [1]]

Diameter of tree, breast-high (inches)	Number of 16-foot logs							Basis (trees)
	2	2½	3	3½	4	4½	5	
	Volume (board feet)							
8	37	52	66	75	84	------	------	12
9	41	58	70	82	93	------	------	9
10	47	66	77	92	100	120	------	12
11	53	74	86	100	120	140	------	13
12	60	83	97	120	140	160	200	8
13	68	94	110	130	160	190	220	4
14	77	110	120	150	180	210	240	7
15	------	120	140	170	200	240	270	11
16	------	130	160	190	230	270	310	20
17	------	150	180	220	260	300	340	21
18	------	170	210	250	280	330	380	20
19	------	190	230	280	320	370	420	34
20	------	210	260	310	360	410	470	27
21	------	------	290	350	400	460	520	33
22	------	------	320	390	440	510	570	40
23	------	------	360	430	490	560	620	37
24	------	------	400	470	540	620	680	37
25	------	------	440	520	600	680	740	47
26	------	------	480	560	660	740	810	52
27	------	------	------	600	720	800	880	43
28	------	------	------	650	780	870	950	45
29	------	------	------	------	840	940	1, 030	39
30	------	------	------	------	910	1, 010	1, 100	47
31	------	------	------	------	------	1, 080	1, 180	40
32	------	------	------	------	------	1, 150	1, 260	44
33	------	------	------	------	------	1, 230	1, 340	39
34	------	------	------	------	------	------	1, 420	36
35	------	------	------	------	------	------	1, 500	34
36	------	------	------	------	------	------	1, 580	29
								840

[1] Gives volumes of trees about as sawed out in average practice.

Correction factors for different species

Hemlock:
For diameters from 8 to 10 inches, add 10 per cent.
For diameters from 11 to 20 inches, add 22 per cent.
For diameters from 21 inches and up, add 20 per cent.

Red spruce:
For diameters from 8 to 10 inches, add 5 per cent.
For diameters from 11 inches and up, add 25 per cent.

Shortleafpine:
For diameters from 10 inches and under, add 15 per cent.
For diameters from 11 to 19 inches, add 25 per cent.
For diameters from 20 to 23 inches, add 35 per cent.
For diameters from 24 inches and over, add 40 per cent.

White pine and other common conifers, for all diameters, use the table without change.

The volume tables are based on diameter breast high, which is the diameter outside bark 4½ feet from the ground. This diameter can be conveniently measured by means of tree calipers; but calipers are somewhat expensive, and home-made calipers or an ordinary carpenter's steel square can be used.

The square is kept horizontal. Both arms are placed in contact with the tree, the shorter one pointing away from the operator; a narrow strip of wood can then be laid against the opposite side of the tree and parallel to the short arm. The diameter of the tree will then be indicated on the long arm.

When the whole area has been estimated, the operator will have a tally of the total number of trees of each size and kind on the tract. Suppose that there are twelve 3-log red oaks 18 inches in diameter and that the volume table for hardwoods indicates that trees of this size contain 260 board feet. The 260 is multiplied by 12. The same thing is done for each of the other sizes for which there is a tally. This gives, then, the total number of board feet of red oak. The same thing is done for other kinds of hardwoods, except that after the total volume has been found it may be necessary to increase it or decrease it for the different species by the amounts indicated in the footnote to the table.

PARTIAL ESTIMATES

In case the woodland is so large or the time available is so short that it is not practicalbe to measure each tree, a partial estimate can be made. One-quarter of the area may be selected as representing a fair sample of the whole. The amount of timber on this sample area may then be multiplied by 4 to get an estimate of the total stand on the whole tract.

Different methods of measuring part of the stand are possible. The simplest of these is to lay out at regular intervals squares or rectangles containing a quarter of an acre, or 1 acre, and to measure all the trees on these plots. If the whole woods contains 50 acres and if 10 plots of an acre each are measured, one-fifth of the area would be covered; therefore the amount of timber found on these plots would have to be multiplied by 5 to obtain the total stand.

There is a tendence in locating plots of this kind to select areas where the timber is better than the average. This must be avoided, for accurate results. A plot 208 feet square contains very nearly 1 acre, and one 104 feet square contains a quarter of an acre.

If the diameter of each tree is to be estimated and not actually measured and the estimator is working without assistance, he may stand at a given point and estimate all of the trees within 59 feet of him. The area of a circle of this size is a quarter of an acre.

The heights, as well as the diameters, of some 10 to 20 trees are measured on each acre. These are needed for getting the volume (board feet, cubic feet, or cords) of a stand. Each height should be read to the same top diameter limit or to the top of the tree, depending upon which is specified in the volume table to be used.

A modification of the sample-plot method is the strip method. Instead of measuring out plots here and there the timber on a strip 66 feet wide is measured. An area of this width and 660 feet long measures 1 acre. At the end of each acre (every 660 feet, or 4 chains) a new tally sheet is begun. The timber is estimated in a continuous strip across the tract. When the boundary of the tract is reached the estimating crew measures off a certain distance (say, 264 feet) at right angles to the strip, and starting there continues the estimating, this time going back toward the first boundary line, and so on. This result

in the gridironing of the tract by these sample areas in such a way that almost invariably all classes of timber are tallied in their proper proportion. (Fig. 12.)

The distance between the center lines of the strips determines what proportion of the tract is covered. If this distance is only 66 feet, all of the tract has been covered; if it is 132 feet, half of the tract; 264 feet, one-quarter of the tract, and so on.

To estimate timber by the strip method it is necessary to have two or more men in the estimating crew. The distance along the strip may be measured with a tape or chain or it may be estimated fairly closely by pacing. The tallyman walks along the center line of the strip and the caliper man or estimator measures or estimates the timber on an area 33 feet wide on each side of the tallyman. If the trees are actually calipered, it takes longer, of course, than if the diameters are estimated by the second man. The estimator calls out

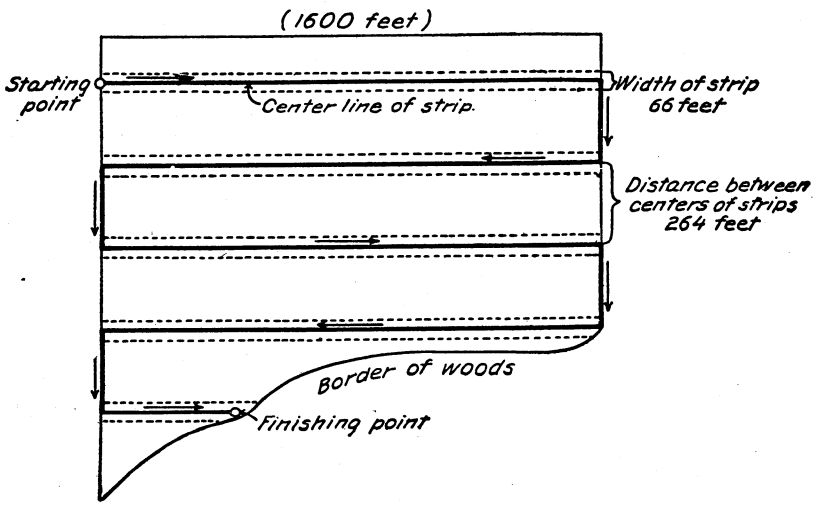


FIGURE 12.—Strip method of estimating 25 per cent of a stand of timber

the species, the diameter, and the height of the tree or number of logs in it; and the tallyman makes the proper entries.

The greater the proportion of the tract which is covered by the strip method the more accurate will be the results; and as a rule at least one-quarter of the area should be included in the strips. This means that the center lines of the strips should be not more than 264 feet apart.

For woodlands of 50 acres or less it is recommended that each merchantable tree be estimated separately. For tracts greater in size either the strip method or the sample-plot method may be used. If only a rough estimate is desired, the sample-plot method can be used to advantage in any case, because it is quicker and its accuracy depends on the care with which the plots are located.

A HOMEMADE DIAMETER MEASURE

A satisfactory substitute for calipers can be easily and quickly made. The cost of standard calipers from dealers ranges from about $5 to $8.

An ordinary carpenter's square forms the beam and fixed arm as shown in Figure 13, *A*. Cut a strip of wood, *B*, about 2 inches longer than the short arm of the square, 1½ inches wide, and about half an inch thick; cut a piece, *C*, from a board having a groove along one edge. Screw or nail *B* and *C* together as shown in the diagram. A third piece, *D*, is fastened first to *B* and then to *C* to act as a brace. Both *C* and *D* should be mortised so as to lie flush with the square. Make sure that *B* is exactly at right angles to *C*, before finally fastening *D* to *C*. This can be done by sliding *C* along until *B* is close to the short end of the square.

To measure a tree hold the instrument horizontally at a height of 4½ feet above the ground (breastheight) and so that both the short and long sides are in contact with the bark. Slide the movable arm over until *B* touches the tree, being careful that *C* stays in close contact with the square. The diameter of the tree can then

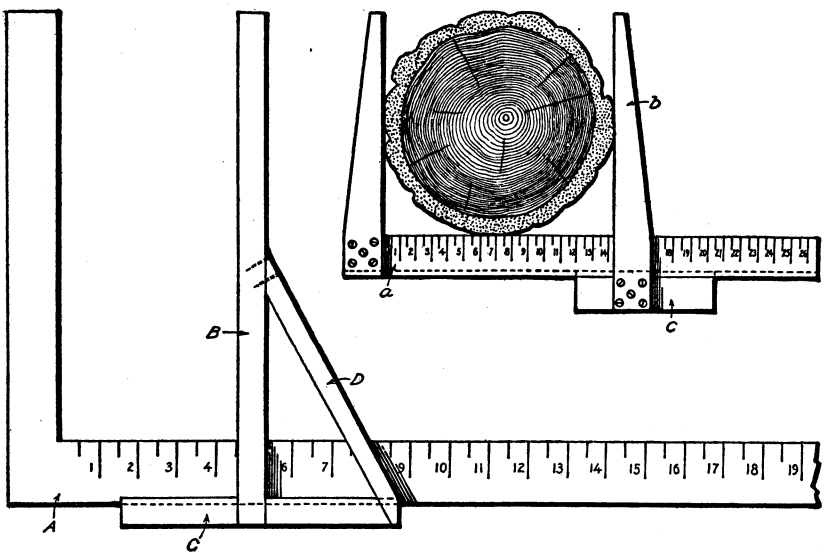


FIGURE 13.—Two patterns for simple homemade instruments, or calipers, for measuring the diameters of trees

be read on the scale of the long arm of the square which touches the tree. The calipers, as described, will need careful handling, since there is nothing to hold the sliding arm parallel and flush with the square. A couple of pieces of strap iron may be easily attached to *C* or to *B* and *D* extending over *A*, as an aid in keeping the sliding arm in right position. It will still be necessary to exercise care in seeing that *C* is kept in close contact with *A* when reading diameters.

Variations in the material used will doubtless suggest themselves. For example, the beam (fig. 13, *a*) and base of the sliding arm *c*, may be made of strong tongue-and-groove material, with the tongue of *c* slightly reduced in order to slide readily. The fixed arm consists of a stick tapered along one side toward the outer end and fastened (with screws) to the surface of *A*. A similar piece tapered on the opposite side (in each case, away from the tree) is fastened to the upper side of *c*. It will be necessary to mark and number inches and half-inches on the beam. Some simple device may be added to hold the sliding arm flush with the beam when in use. This has been found to be an easily made and serviceable instrument.

A HOMEMADE HEIGHT MEASUREMENT

An instrument for measuring the heights of trees can easily be made at practically no cost. (Fig. 14.)

Take a piece of half-inch board 7 by 9 inches and plane it smooth on all sides. Draw the line *AB* three-eights of an inch from the lower edge and parallel to it. Two inches from the left end of the board draw *CD* at right angles to *AB*. Make a mark at E, 6¼ inches from *D*, and another at *F*, 3⅜ inches from *D*. Now draw a line *JK* through

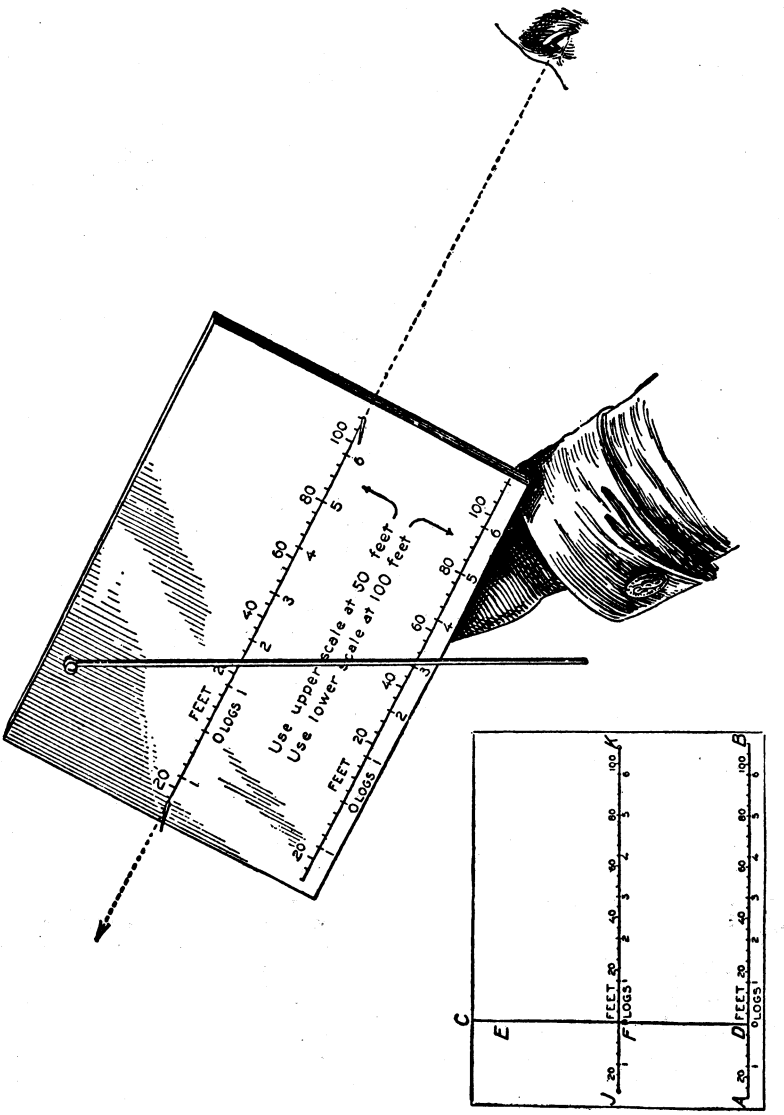
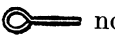
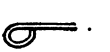


FIGURE 14.—A simple homemade instrument for measuring heights of trees

F parallel to *AB*. Start at *D*, lay off inches and quarter inches on *AB* in both directions, marking *D* as zero and putting down the number of inches from *D* to each inch mark. Do the same for the line *JK*. Take a brad or small nail and drive it in carefully on the line *JK* about an inch from the edge of the board. Drive it in until

the point comes out on the back of the board; then pull it out and drive it in from the back until the point sticks out about one-fourth inch form the face of the board. File off or cut off with pliers any part of the brad that projects from the back of the board. In the same way insert another brad near the other end of the line *JK*. These brads are the sights, and it is important that they be straight and true.

Now take a piece of straight, heavy wire 10 inches long and bend one end of it into a loop about an eighth of an inch in diameter. The center of the loop should be in line with the straight part of the wire thus:  not thus  . Fasten this piece of wire loosely to the board at *E* with a half-inch screw, so that it will swing freely when the board is on edge. The loop should be big enough to fit loosely over the shank of the screw, but small enough so that it will not slip off over the head.

Screw a piece of wood about 6 inches long, 1 inch wide, and half an inch thick to the back of the board to serve as a handle, and the height measure is complete.

How to use it.—To measure the total height of a tree, stand at a distance of 100 feet from it and hold the instrument in the right hand in such a way that the pendulum swings freely but very near the board. Sight along the brads at the top of the tree and let the pendulum come to rest. Then with the left hand press the pendulum against the board without giving it a chance to change its position. Now read off the number of feet in height on the lower scale. If the wire crosses the line 5 inches from the point *D*, it indicates that the tree is five 16-foot logs, or 80 feet, high above the level of the eye. Now sight at the foot of the tree and take another reading. If the pendulum hangs to the left of *D*, that is, between *A* and *D*, add the amount indicated to the first reading, and the result will be the total height of the tree. Thus, if it hangs half an inch to the left of *D*, add half a log, or 8 feet, to the first reading, making a total of five and one-half logs, or 88 feet. But if the eye is below the foot of the tree, the wire will hang to the right of *D* (between *D* and *B*) and then the amount of the second reading should be subtracted from the amount of the first. Thus, if the first reading is 96 feet and the second is 12 feet (to the right of *D*), the total height of the tree will be 96 less 12, or 84 feet. If the tree is less than about 75 feet high, or if it is difficult to see the top at a distance of 100 feet, the observer should stand 50 feet from the tree, but in this case the readings are on the line *JK*.

When the instrument is sighted the pendulum can be kept in position by tilting the hand slightly to the right. This brings the wire against the board and holds it in place so that a reading can be obtained. Care should be taken, however, so that the wire will not slip after the board is tilted.

In the example given, the total height of the tree has been measured. It is often of more practical importance to measure the height to a point on the tree beyond which there is no merchantable saw timber. This measurement is made in the same way as that described above, except that the instrument is pointed at what will

be the top of the last log when the tree is cut, and then at the point where the top of the stump will be.

ESTIMATING CORDWOOD

Cordwood can be estimated without volume tables in much the same way as saw timber. The diameter of the stick is measured at the middle outside bark instead of at the small end inside bark. The figures below show the volume in cubic feet of 4-foot sticks of ordinary dimensions.

Diameter of sticks (inches)	2	3	4	5	6	7	8	9	10	11	12
Solid contents (cubic feet)	0.1	0.2	0.3	0.5	0.8	1.1	1.4	1.8	2.2	2.6	3.1

The branches, or that part of the stem which is suitable for cordwood, may be laid off by eye into 4-foot lengths, then the diameter at the middle of each of these is estimated and tallied on a sheet of paper ruled in squares. The total number of sticks of any size is multiplied by the number of cubic feet corresponding to that size, which is obtained from the table; and this is continued until the total volume of each class of sticks has been obtained. These volumes added together give the total number of cubic feet in the tree or trees under consideration.

Though a cord contains 128 cubic feet, the space occupied includes both wood and air. The actual solid contents of a cord averages only about 70 per cent of this amount, or 90 cubic feet for wood of average size. To obtain the number of cords it is necessary, then, to divide the total number of cubic feet by 90. For small sticks, where the average diameter is 4 inches or less, a converting factor of 80 cubic feet per cord should be used; in the case of larger sticks, 10 inches or over in diameter, the converting factor may run as high as 100 cubic feet per cord. For ordinary firewood sizes 90 cubic feet will be satisfactory. Crooked, rough sticks can not be piled as closely as straight smooth sticks, therefore a certain quantity of crooked wood will make a greater number of cords than the same amount of straight wood.

There are usually about 500 board feet in a cord. Thus 10 cords of medium-sized pulpwood, containing 500 board feet per cord are equivalent to 5,000 board feet. Large-sized wood, however, might contain 600 board feet to the cord, so that 10 cords would be equivalent to 6,000 board feet. Crooked wood contains somewhat less than 500 board feet, and very close sawing of the timber may give an equivalent as high as 675 board feet.

In some cases it may be desirable to know how much the volume will be reduced by peeling cordwood. The thinnest barked trees usually have at least 6 per cent of the total volume in the form of bark, and from this it ranges up to 30 per cent.

FINDING THE SALE VALUE OF STANDING TIMBER

Woodland owners often sell their timber without having a sufficient knowledge of its market value to protect their interests, and suffer loss in consequence. Such loss can be avoided only by a careful and thorough study of all available markets.

The value of a standing tree is mainly affected by the kind or species of the tree and its size, soundness, straightness, and location or accessibility to market.

IMPORTANT STEPS

The following steps may be of assistance in acquiring a knowledge of the sale value of timber:

(1) Take advantage of the experience of neighbors who have recently sold timber or have otherwise informed themselves in regard to good markets and current prices.

Doubtless the preponderance of poor bargains over good ones has something to do with the proverbial reticence of farmers on the subject of their timber sales. It is not unusual to find cases where adjacent farmers have sold approximately the same grade of material at about the same time for widely different prices. In communities where the cooperative spirit is strong, stumpage values usually become pretty well known.

(2) Apply to the State forester, the county agricultural agent, or any other available public official or personal agency for sources of information and advice regarding possible markets and timber prices.

(3) Employ the services of some reliable man who has made a special study of market prices of logs and lumber. The saving gained thereby, unless the owner has had much experience along that line, may amount to from 10 to 40 times the cost of the examination.

The opportunity in this field is particularly promising. In most sections where timber has been sold to any extent in the past, men of the necessary qualifications can be found whose employment by the day or the job would be of very real assistance to owners of timber and enable them to keep up with market conditions.

(4) Get into touch, through correspondence, with outside buyers, and thus awaken competition among as many prospective purchasers as possible. A live effort along this line will often bring about an open market for standing timber.

(5) Determine the value of the material by reference to current market prices and the total cost of putting it on the market.

STUMPAGE VALUE

The sale value of standing timber, known as its stumpage value, is of primary importance to the owner. Many small timber sales are based upon the value of timber in the standing tree, rather than on its later value when cut and placed on the market in the form of cordwood, ties, poles, bolts, logs for further manufacture, or lumber.

With a knowledge of the market price and the cost of getting the material from the stump to the market the owner is in a position to ascertain by a simple calculation the value of his standing timber. This is the difference between the value of the product on the market and the total cost of marketing, including a reasonable profit on the operation, which may fairly be placed at from 20 to 30 per cent on the combined investment in timber, labor, and lumbering equipment.

For example, if average mill-run red-oak lumber is worth $40 per thousand feet at a market point and the total cost of logging, sawing, and hauling, including a fair profit on the business is $26, the value of the standing timber is $14 per thousand board feet. In the same manner the stumpage value of poles, ties, and other primary timber products may be obtained. If a 35-foot pine pole is worth $5 delivered at a loading point along the railroad, and the cost of logging and hauling, plus a profit of 20 per cent on the operation, is $3.10, the stumpage value is $1.90. Likewise, if the average value

of a grade 5 white-oak tie is $1 and the cost of cutting, hewing, and hauling, plus a fair profit, is 65 cents, the stumpage value would be 35 cents. Maple and beech cordwood, selling for $7 per cord in a given town and costing $2 for cutting, $3 for hauling, and 50 cents profit, a total of $5, has a stumpage value of $1.50 per cord.

The value of timber in the tree is affected by its location and accessibility, since these determine largely the cost of production and marketing. The distance, character of the road, and daily hauling capacity of a team and wagon are factors to be taken into account. Through improved methods of logging and transportation, timber becomes relatively more accessible, and the cost of production is reduced, its stumpage value being then increased. Efficiency of labor, teams and machinery employed in logging, economy in utilizing material and conducting the operation, and skill in securing the best market for the product, whether sold in the log or in a manufactured state, all count as factors in raising the value of standing timber.

TABLE 12.—*Equivalent lumber values of different grades of ties sold at various prices*

[Cost of sawing assumed to be $8 per thousand board feet for 1-inch lumber, and 20 cents per tie. Loss of one-fifth the timber scale by sawing 1-inch lumber as compared with sawing the material into ties]

Grade of tie	Price received per tie									
	$0.30	$0.40	$0.50	$0.60	$0.70	$0.80	$0.90	$1.00	$1.10	$1.20	$1.30
	Value per thousand board feet, 1-inch lumber										
No. 1: Size, 6 by 6 inches by 8 feet (contents, 24 board feet or 42 ties per M board feet)	$13.25	$18.50	$23.75	$29.00	$34.25	$39.50	$44.75	$50.00	$55.25	$60.50	$65.75
No. 2: Size, 6 by 7 inches by 8 feet (contents, 28 board feet or 36 ties per M board feet)	12.60	17.10	21.50	26.00	30.50	35.00	39.50	44.00	48.50	53.00	57.50
No. 3: Size, 6 by 8 inches by 8 feet (contents, 32 board feet or 31 ties per M board feet)	12.00	15.80	19.65	23.50	27.40	31.25	35 10	39.00	42.90	46.70	50.60
No. 4: Size, 7 by 8 inches by 8½ feet (contents, 40 board feet or 25 ties per M board feet)	11.20	14.25	17.38	20.50	23.62	26.75	29.88	33.00	36.12	39.25	42.38
No. 5: Size, 7 by 9 inches by 8½ feet (contents, 45 board feet or 22 ties per M board feet)	10.60	13.40	16.25	19.00	21.75	24.50	27.25	30.00	32.75	35.50	38.25

In determining stumpage values it is only fair to base the calculation upon the product of highest value for which the tree is suited. For example, if white oak is sawed into wagon stock of specified sizes worth $60 per thousand board feet, the return in stumpage value is $24 for each thousand feet of lumber sold.[5] It would be only $10 if the same material had been sawed into ties worth $1 each.[6] Allowing a sawing cost of 20 cents each for ties and $8 per 1,000 feet for sawing 1-inch lumber, a given amount of log material will net $22.50, whether sawed into ties (7 by 8 inches by 8½ feet) and sold at $1.10 each or into 1-inch lumber at $36.12 per thousand feet.[7] Table 12 gives the equivalent returns per thousand board

[5] Allowing a cost of $36 per thousand for production and marketing of 1,000 feet of lumber.

[6] Allowing $15 (or 60 cents each) for making and marketing 25 ties, the number of 7 by 8 inch by 8½ foot ties derived from the material yielding 1,000 feet of rough lumber, using a saw cutting ¼-inch saw kerf.

[7] One-fifth of the timber scale is lost by saw kerf with the ordinary circular saw, and therefore a tie containing 40 board feet by actual scale would yield only 32 board feet of 1-inch lumber.

feet of 1-inch lumber for material worked into ties of different sizes and sold at various prices. For example, if grade 3 ties (6 by 8 inches by 8 feet) are selling at 90 cents each, the returns are approximately equal to selling the same material in the form of lumber at $35.10 per thousand board feet.

If the owner takes part in the lumbering, his profits from stumpage value are increased by profits from the operation proportional to the extent to which his labor and capital go into the logging, milling, and marketing of the product. Under certain conditions he may be able actually to sell the sawed product of his woods. Usually the farmer is not sufficiently equipped or experienced to accomplish this profitably. He is able, however, in many cases to market his timber direct to the consumer in the form of logs (fig. 15), bolts, poles,

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FIGURE 15.—A butt log of which the owner may well be proud, as well as careful to dispose of at a fair price

piling, and cordwood. In general, an advance in stumpage values of all woodland products has been in progress throughout the country. It would be very profitable for the farmer to make a greater effort to acquaint himself fully with general market conditions and stumpage values and to place a corresponding value on his timber resources before making further sales or even local use of his timber.

MARKETING COSTS

The principal operations necessary to get the product from the stump to the market are:

Cutting, logging, and rough working the trees in the woods. This includes such operations as cutting logs and bolts, hewing ties, peeling poles, etc., and often ranking and piling them for convenience. In case the material is worked up in a portable mill on the ground or near by, the short haul to the mill should be included here.

Transporting the product of whatever kind to the railroad, wood-using plant, sawmill, town yard, or other market. The assumption

here is that the material is sold and shipped considerable distances, so that it is known to have a certain value at some definite point.

Further manufacture to produce certain kinds of products, such as sawed lumber, sawed ties, etc. Bolts, hewed ties, poles, mining timbers, and other products require no further treatment for their marketing.

Usually local cost figures for logging and rough working are readily obtainable. The most variable cost is that of hauling and transportation, because of the varying distances, means of transportation, and differences in weight of different kinds of timber in a green and seasoned condition. The third item, the expense of sawing lumber, ties, or other materials before they are considered to be on the market, is probably the least variable of the three different items. The density and weight of the wood has a good deal to do with the transportation and milling items in the marketing costs.[8] Pine and cottonwood, for instance, cost less to haul and cut than oak and hickory.

MARKETS AND PRICES

The farmer's market will be found at a sawmill, lumber yard, woodworking plant, railroad station or siding, mining company, electric-light company, traction company, or general contractor's office. The market may be local or at some distance. In some regions where supplies are limited and prices high the stationary sawmill, obtaining its raw products by rail and long-haul wagon delivery, is superseding the portable mill. This is particularly true in the regions of oak, hickory, and other more valuable hardwoods.

It is well to have clearly in mind the different prices for wood products as they advance successively from the tree to manufacture and market. Thus the stumpage price and the market price, or base price, stand at the two extremities. Local and f. o. b. prices are intermediate prices. By "local" price is often meant that which the buyer would pay for wood material delivered at the railroad or other supply point. The "f. o. b." price is the price of material "free on board" cars at some point designated, as f. o. b. mill (fig. 16) or f. o. b. railroad. It equals the base price, or price on the general market, minus the cost of freight from the shipping point to the market point.

Market values of timber products may be learned from local mills and lumber yards, markets, and jobbers in the cities.

For prices and specifications on crossties, requests should be made to the local railroad agent or direct to the general purchasing agents, whose addresses can be obtained from the passenger-service folders or learned by inquiring at the local stations. Mining companies furnish similar information in regard to their needs. Poles are purchased by electric lighting and power companies, electric traction companies, telegraph and telephone companies, and others, to whom requests for information should be sent direct. For prices on piling it would be well to look to the railroad and to dock, wharf, bridge, and bulkhead contractors in the larger towns and cities. Cordwood is purchased by brickmakers, bakeries, lime-kiln operators, packing houses, and fuel dealers.

[8] Average marketing costs, itemized separately for lumber, ties, poles, cordwood, and charcoal in New York will be found in Bulletin 9, Woodlot Forestry, State of New York Conservation Commission, 1913; also, for white-pine lumber in New Hampshire in Extension Bulletin No. 3, Marketing White Pine in New Hampshire, New Hampshire College and Experiment Station, Durham, N. H.

State foresters, State extension foresters, and local agricultural county agents are often able to furnish valuable hints and other assistance in locating buyers of rough materials from the farm woodland, and should be consulted by owners desiring such aid.

SHIPPING BY RAIL

When a shipment is made by rail, obtain from the local railroad agent the freight rate in carload lots for the given commodity between the shipping point and the destination. (Fig. 17.) The rate obtained is then applied to the total weight of the commodity as shown in Tables 1 to 5. This will give the approximate but not exact cost of shipment. Rates for shipment in carload lots are generally quoted per 100 pounds, with a stated minimum weight for which payment must be made. Shipments in less-than-carload lots are impracti-

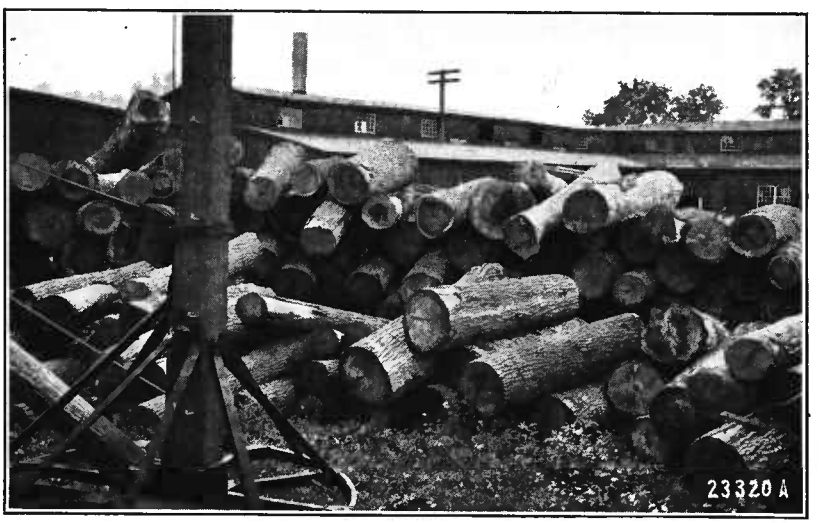

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FIGURE 16.—White oak and yellow poplar logs at a veneer plant

cable because of the very high cost. The following example will illustrate the method: Suppose the freight tariff on "bolts" is 6.3 cents per 100 pounds between two specified railroad points, and a farmer wishes to ship a carload of dry elm bolts to a cooperage plant at the given destination. The material weighs 2,400 pounds per cord [9] and 18 cords are to be loaded on the car. The total weight will be 43,200 pounds and the cost will be $27.22 for the carload, or an average of $1.51 per cord. Since 40,000 pounds is the minimum weight for this class of material on this railroad, the least charge for a shipment by carload rates would be $25.20. Thus if less than 16.7 cords are loaded on a car, the cost per cord will increase in proportion as the total weight of the contents falls below the minimum. The tariff sheet of one railroad lists 58 different commodities under the heading, "Lumber and forest products," with minimum weight varying from 34,000 pounds for sawdust and pulp wood to 40,000 pounds for logs, bolts, and firewood. For the heavy cars over trunk lines,

[9] Bolts averaging 12 inches in diameter and 3 feet long, making a short cord 3 feet in width. (See Table 2.)

and to certain destinations, minimums up to 60,000 pounds are quoted. Cars may not be loaded in excess of 10 per cent of their marked weight capacity. Usually the rate is about the same for the principal kinds of timber products over the same haul. Tables 13

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FIGURE 17.—Hickory stock 40 inches long for ax, pick, and sledge handles

and 14 show the approximate cost of shipping logs and lumber, per 1,000 board feet, both green and air dry, of different species, at rates of from 2 to 10 cents per 100 pounds.

In selling logs and other products to outside markets it is a good thing to effect the sale at a price for the material delivered at the

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FIGURE 18.—Red oak for cooperage and piling, hickory blocks for automobile spokes, and mixed hardwood saw logs at a country shipping point

railroad, either in the yard or aboard the cars. (Fig. 18.) Then the buyer, rather than the farmer, handles the shipping end of the business. The chances are that by this arrangement the farmer may realize more profit than if he had sold f. o. b. the destination point.

TABLE 13.—*Cost of shipping logs, green and air-dry, per 1,000 board feet (Doyle scale), at rates of from 2 to 14 cents per 100 pounds*

[Costs given are for logs measuring 18 inches in diameter at the small end. For 12-inch logs add 40 per cent and for 24-inch logs subtract 15 per cent of the costs given. Weights used are those shown in Table 1]

Species	Rates in cents per hundred pounds												
	2	3	4	5	6	7	8	9	10	11	12	13	14
	Cost of shipping 1,000 board feet												
Hardwoods													
Ash:													
Green	$1.54	$2.31	$3.08	$3.85	$4.62	$5.39	$6.16	$6.93	$7.70	$8.47	$9.24	10.01	$10.78
Air-dry	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.12	6.80	7.48	8.16	8.84	9.52
Basswood:													
Green	1.32	1.98	2.64	3.30	3.96	4.62	5.28	5.94	6.60	7.26	7.92	8.58	9.24
Air-dry	.82	1.23	1.64	2.05	2.46	2.87	3.28	3.69	4.10	4.51	4.92	5.33	5.74
Beech:													
Green	1.78	2.67	3.56	4.45	5.34	6.23	7.12	8.01	8.90	9.79	10.68	11.57	12.46
Air-dry	1.40	2.10	2.80	3.50	4.20	4.90	5.60	6.30	7.00	7.70	8.40	9.10	9.80
Birch, yellow:													
Green	1.84	2.76	3.68	4.60	5.52	6.44	7.36	8.28	9.20	10.12	11.04	11.96	12.88
Air-dry	1.44	2.16	2.88	3.60	4.32	5.04	5.76	6.48	7.20	7.92	8.64	9.36	10.08
Cherry, black: [1]													
Green	1.46	2.19	2.92	3.65	4.38	5.11	5.84	6.57	7.30	8.03	8.76	9.49	10.22
Air-dry	1.16	1.74	2.32	2.90	3.48	4.06	4.64	5.22	5.80	6.38	6.96	7.54	8.12
Chestnut:													
Green	1.76	2.64	3.52	4.40	5.28	6.16	7.04	7.92	8.80	9.68	10.56	11.44	12.32
Air-dry	.98	1.47	1.96	2.45	2.94	3.43	3.92	4.41	4.90	5.39	5.88	6.37	6.86
Cottonwood: [2]													
Green	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50	8.25	9.00	9.75	10.50
Air-dry	.88	1.32	1.76	2.20	2.64	3.08	3.52	3.96	4.40	4.84	5.28	5.72	6.16
Elm:													
Green	1.66	2.49	3.32	4.15	4.98	5.81	6.64	7.47	8.30	9.13	9.96	10.79	11.62
Air-dry	1.20	1.80	2.40	3.00	3.60	4.20	4.80	5.40	6.00	6.60	7.20	7.80	8.40
Gum, red:													
Green	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50	8.25	9.00	9.75	10.50
Air-dry	1.10	1.65	2.20	2.75	3.30	3.85	4.40	4.95	5.50	6.05	6.60	7.15	7.70
Hickory:													
Green	2.06	3.09	4.12	5.15	6.18	7.21	8.24	9.27	10.30	11.33	12.36	13.39	14.42
Air-dry	1.66	2.49	3.32	4.15	4.98	6.81	6.64	7.47	8.30	9.13	9.96	10.79	11.62
Maple, sugar:													
Green	1.80	2.70	3.60	4.50	5.40	6.30	7.20	8.10	9.00	9.90	10.80	11.70	12.60
Air-dry	1.40	2.10	2.80	3.50	4.20	4.90	5.60	6.30	7.00	7.70	8.40	9.10	9.80
Oak, red:													
Green	2.06	3.09	4.12	5.15	6.18	7.21	8.24	9.27	10.30	11.33	12.36	13.39	14.42
Air-dry	1.40	2.10	2.80	3.50	4.20	4.90	5.60	6.30	7.00	7.70	8.40	9.10	9.80
Oak, white:													
Green	2.00	3.00	4.00	5.00	5.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00
Air-dry	1.54	2.31	3.08	3.85	4.62	5.39	6.16	6.93	7.70	8.47	9.24	10.01	10.78
Sycamore:													
Green	1.68	2.52	3.36	4.20	5.04	5.88	6.72	7.56	8.40	9.24	10.08	10.92	11.76
Air-dry	1.16	1.74	2.32	2.90	3.48	4.06	4.64	5.22	5.80	6.38	6.96	7.54	8.12
Yellow poplar:													
Green	1.22	1.83	2.44	3.05	3.66	4.27	4.88	5.49	6.10	6.71	7.32	7.93	8.54
Air-dry	.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50	4.95	5.40	5.85	6.30
Tupelo: [3]													
Green	2.10	3.15	4.20	5.25	6.30	7.35	8.40	9.45	10.50	11.55	12.60	13.65	14.70
Air-dry	1.18	1.77	2.36	2.95	3.54	4.13	4.72	5.31	5.90	6.49	7.08	7.67	8.26
Walnut:													
Green	1.66	2.49	3.32	4.15	4.98	5.81	6.64	7.47	8.30	9.13	9.96	10.79	11.62
Air-dry	1.14	1.71	2.28	2.85	3.42	3.99	4.56	5.13	5.70	6.27	6.84	7.41	7.98
Softwoods													
Fir, Douglas:													
Green	1.22	1.83	2.44	3.05	3.66	4.27	4.88	5.49	6.10	6.71	7.32	7.93	8.54
Air-dry	1.08	1.62	2.16	2.70	3.24	3.78	4.32	4.86	5.40	5.94	6.48	7.02	7.56
Pine, longleaf:													
Green	1.54	2.31	3.08	3.85	4.62	5.39	6.16	6.93	7.70	8.47	9.24	10.01	10.78
Air-dry	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.12	6.80	7.48	8.16	8.84	9.52
Pine, Norway (red):													
Green	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.12	6.80	7.48	8.16	8.84	9.52
Air-dry	1.10	1.65	2.20	2.75	3.30	3.85	4.40	4.95	5.50	6.05	6.60	7.15	7.70
Pine, shortleaf:													
Green	1.44	2.16	2.88	3.60	4.32	5.04	5.76	6.48	7.20	7.92	8.64	9.36	10.08
Air-dry	1.16	1.74	2.32	2.90	3.48	4.06	4.64	5.22	5.80	6.38	6.96	7.54	8.12
Pine, white:													
Green	1.26	1.89	2.52	3.15	3.78	4.41	5.04	5.67	6.30	6.93	7.56	8.19	8.82
Air-dry	.86	1.29	1.72	2.15	2.58	3.01	3.44	3.87	4.30	4.72	5.16	5.59	6.02
Spruce, red:													
Green	1.08	1.62	2.16	2.70	3.24	3.78	4.32	4.86	5.40	5.94	6.48	7.02	7.56
Air-dry	.92	1.38	1.84	2.30	2.76	3.22	3.68	4.14	4.60	5.06	5.52	5.98	6.44

[1] Silver maple is about the same as black cherry, which may be substituted.
[2] For willow use figures for cottonwood, adding 10 per cent for green and subtracting 8 per cent for dry.
[3] For black gum use figures for tupelo.

TABLE 14.—*Cost of shipping 1-inch lumber, green and air-dry, per thousand board feet, at rates of from 2 to 14 cents per hundred pounds*

[Weights used are those given in Table 1]

Species	Rates in cents per hundred pounds												
	2	3	4	5	6	7	8	9	10	11	12	13	14
	Cost of shipping 1,000 board feet												
Hardwoods													
Ash:													
Green	$0.80	$1.20	$1.60	$2.00	$2.40	$2.80	$3.20	$3.60	$4.00	$4.40	$4.80	$5.20	$5.60
Air-dry	.70	1.05	1.40	1.75	2.10	2.45	2.80	3.15	3.50	3.85	4.20	4.55	4.90
Basswood:													
Green	.68	1.02	1.36	1.70	2.04	2.38	2.72	3.06	3.40	3.74	4.08	4.42	4.76
Air-dry	.42	.63	.84	1.05	1.26	1.47	1.68	1.89	2.10	2.31	2.52	2.73	2.94
Beech:													
Green	.92	1.38	1.84	2.30	2.76	3.22	3.68	4.14	4.60	5.06	5.52	5.98	6.44
Air-dry	.72	1.08	1.44	1.80	2.16	2.52	2.88	3.24	3.60	3.96	4.32	4.68	5.04
Birch, yellow:													
Green	.96	1.44	1.92	2.40	2.88	3.36	3.84	4.32	4.80	5.28	5.76	6.24	6.72
Air-dry	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70	4.07	4.44	4.81	5.18
Cherry, black:[1]													
Green	.76	1.14	1.52	1.90	2.28	2.66	3.04	3.42	3.80	4.18	4.56	4.94	5.32
Air-dry	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.90	4.20
Chestnut:													
Green	.92	1.38	1.84	2.30	2.76	3.22	3.68	4.14	4.60	5.06	5.52	5.98	6.44
Air-dry	.50	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50
Cottonwood:[2]													
Green	.72	1.08	1.44	1.80	2.16	2.52	2.88	3.24	3.60	3.96	4.32	4.08	5.04
Air-dry	.44	.66	.88	1.10	1.32	1.54	1.76	1.98	2.20	2.42	2.64	2.86	3.08
Elm:													
Green	.86	1.29	1.72	2.15	2.58	3.01	3.44	3.87	4.30	4.73	5.16	5.59	6.02
Air-dry	.62	.93	1.24	1.55	1.86	2.17	2.48	2.79	3.10	3.41	3.72	4.03	4.34
Gum, red:													
Green	.78	1.17	1.56	1.95	2.34	2.73	3.12	3.51	3.90	4.29	4.68	5.07	5.46
Air-dry	.56	.84	1.12	1.40	1.68	1.96	2.24	2.52	2.80	3.08	3.36	3.64	3.92
Hickory:													
Green	1.04	1.56	2.08	2.60	3.12	3.64	4.16	4.68	5.20	5.72	6.24	6.76	7.28
Air-dry	.86	1.29	1.72	2.15	2.58	3.01	3.44	3.87	4.30	4.73	5.16	5.59	6.02
Maple, sugar:													
Green	.94	1.41	1.88	2.35	2.82	3.29	3.76	4.23	4.70	5.17	5.64	6.11	6.58
Air-dry	.72	1.08	1.44	1.80	2.16	2.52	2.88	3.24	3.60	3.96	4.32	4.68	5.04
Oak, red:													
Green	1.08	1.62	2.16	2.70	3.24	3.78	4.32	4.86	5.40	5.94	6.48	7.02	7.56
Air-dry	.72	1.08	1.44	1.80	2.16	2.52	2.88	3.24	3.60	3.96	4.32	4.68	5.04
Oak, white:													
Green	1.04	1.56	2.08	2.60	3.12	3.64	4.16	4.68	5.20	5.72	6.24	6.76	7.28
Air-dry	.80	1.20	1.60	2.00	2.40	2.80	3.20	3.60	4.00	4.40	4.80	5.20	5.60
Sycamore:													
Green	.86	1.29	1.72	2.15	2.58	3.01	3.44	3.87	4.30	4.73	5.16	5.59	6.02
Air-dry	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.90	4.20
Yellow poplar:													
Green	.64	.96	1.28	1.60	1.92	2.24	2.56	2.88	3.20	3.52	3.84	4.16	4.48
Air-dry	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.40	2.64	2.88	3.12	3.36
Tupelo:[3]													
Green	1.10	1.65	2.20	2.75	3.30	3.85	4.40	4.95	5.50	6.05	6.60	7.15	7.70
Air-dry	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.90	4.20
Walnut:													
Green	.86	1.29	1.72	2.15	2.58	3.01	3.44	3.87	4.30	4.73	5.16	5.59	6.02
Air-dry	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.90	4.20
Softwoods													
Fir, Douglas:													
Green	.62	.93	1.24	1.55	1.86	2.17	2.48	2.79	3.10	3.41	3.72	4.03	4.34
Air-dry	.56	.84	1.12	1.40	1.68	1.96	2.24	2.52	2.80	3.08	3.36	3.64	3.92
Pine, longleaf:													
Green	.80	1.20	1.60	2.00	2.40	2.80	3.20	3.60	4.00	4.40	4.80	5.20	5.60
Air-dry	.70	1.05	1.40	1.75	2.10	2.45	2.80	3.15	3.85	3.85	4.20	4.55	4.90
Pine, Norway (red):													
Green	.70	1.05	1.40	1.75	2.10	2.45	2.80	3.15	3.50	3.85	4.20	4.55	4.90
Air-dry	.56	.84	1.12	1.40	1.68	1.96	2.24	2.52	2.80	3.08	3.36	3.64	3.92
Pine, shortleaf:													
Green	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70	4.07	4.44	4.81	5.18
Air-dry	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60	3.90	4.20
Pine, white:													
Green	.64	.96	1.28	1.60	1.92	2.24	2.56	2.88	3.20	3.52	3.84	4.16	4.48
Air-dry	.44	.66	.88	1.10	1.32	1.54	1.76	1.98	2.20	2.42	2.64	2.86	3.08
Spruce, red:													
Green	.56	.84	1.12	1.40	1.68	1 96	2.24	2.52	2.80	3.08	3.36	3.64	3.92
Air-dry	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.40	2.64	2.88	3.12	3.36

[1] For silver maple use figures for black cherry, since the weights are about the same.
[2] For willow use figures for cottonwood, adding about 20 per cent for green lumber.
[3] For black gum use figures for tupelo, since the weights are about the same.

The amount of forest products of any kind that can be shipped in or on a car varies with both the cubical and weight capacity of the car. The approximate amounts of different kinds of forest products that can be shipped in the average 60,000-pound capacity car are given below.

Lumber:		
Rough	board feet	15, 000–18, 000
Finished	do	17, 000–20, 000
Logs:		
Large, 24 inches	do	5, 000–7, 000
Small, 12 inches	do	4, 000–5, 000
Bolts or butts	cords	12–16
Cordwood, 4 feet	do	15–18
Stove wood, 16 inches	ranks	30–40
Mine timber. (See Posts, Poles, Logs.)		
Poles or piling	pieces	25–40
Ties:		
7 by 9 inches by 8½ feet	do	300
6 by 8 inches by 8 feet	do	350
5 by 6 inches by 5½ feet (mine tie)	do	1, 100
Posts:		
4-inch top, 7 feet		800
6-inch top, 8 feet		500
Tanbark	cords	16–18
Sawdust	tons	12–18

WHEN TO SELL

Woodland owners do not always know when to sell standing timber and when to use it for local needs. In some localities it unquestionably pays the farmer better at all times to sell it, particularly the more valuable kinds. For example, in the central hardwood region farmers sell their select yellow poplar trees profitably and with the money purchase and haul back to the farm for distances of from 4 to 8 miles southern pine siding for their houses and barns. On the other hand, there are too often instances where one finds choice white oak of the best quality for veneer or furniture stock sawed up into posts for the farm.

The owner should keep in touch with market conditions in order that he may market his product to the best advantage. With rarely an exception the timber is not dying, decaying, or "going back" by fungous or insect attack at the rapid rate alleged by buyers, who, obvioulsy, desire to buy as cheaply as possible; and, unless it is overmature, it is increasing yearly in volume and value. Cutting during the early period often represents a real sacrifice in financial returns. The approximate age at which trees should be cut in order to secure the highest net money returns per year is very different for different species. Thus cottonwood, ash, and yellow poplar become commercially valuable at much earlier ages than white oak and black walnut.

When other farm work is least pressing the farmer should give attention to estimating, measuring, cutting, marketing, and selling his timber. Spare help and time to supervise the work make the winter a favorable season. It is easier to haul logs on the snow than over ordinary roads, and the logs are less liable than at any other time of the year to deteriorate quickly through attacks of insects of fungi.

HOW TO SELL

In managing his woodlands, it is essential for the farmer to keep in mind as his timber crop the rough timber products, including logs, bolts and billets, piling, poles, crossties, posts, and cordwood. The farmer should so far as possible cut or harvest his own timber crop in the form of rough products. Thus, along with his timber he will sell his labor and that of his team or truck. This is the way he does with his wheat, cotton, or corn. Cutting his own timber products means an increased money income and also the woods left in better condition for growing another timber crop. He should, as a rule, keep out of the sawmill business and be a producer and not a manufacturer of timber products. The exception is the farmer who carries on a sawmill business during the off months, providing himself with a winter business and a supply of lumber for himself and the community.

The choice of methods of selling will depend largely upon the kind of timber and the owner's knowledge of its value, his past experience, and the condition of the market. Timber products are sold either in the standing tree or in a more or less roughly manufactured condition. Except when sold by the lot or lump, sales are based upon a measure by log scale or lumber tally or upon individual count of units of designated size or character.

SELLING BY LOT OR LUMP

Timber sold by the lot, boundary, or tract is either "lumped off" to include a designated tract or sold on an acreage basis.

This method has prevailed over all others, particularly in the rougher and less settled districts. As a rule it is strongly favored by the purchaser because in such a transaction his better knowledge of both timber yields and values gives him an advantage over the average owner. Many examples of the sacrifice by the owner of a large share of the value of the timber can be found in nearly any wooded region. On account of greater competition among purchasers and an increase in timber values, sales of standing timber by the lot or lump are now being made with better profit than formerly.

In using this method it is very important in advance of the sale (1) to secure a good estimate of the amount, quality, and unit value of each kind of product in the stand; (2) to get bids from as many buyers as possible; and (3) to have an agreement clearly specifying the restrictions in regard to the manner and amount of cutting, so as not to impair the producing power of the forest. The sale may include only trees above a specified minimum diameter limit, or such trees as have been previously marked by the owner for cutting. Suggestions of conditions which may or may not be included in the timber sale, according to the local conditions and the wishes of the owner, will be found on pages 49 to 51. When safeguarded in the manner suggested above, this method becomes one of the safest and most satisfactory of all methods of selling and should receive full consideration when sales are contemplated.

Selling by lump eliminates the anxiety and misunderstandings attending sales by log-scale measurement. If competition is keen, it is likely that nearly or quite the full value of the timber will be reached in the bids. By this method, however, the owner foregoes the opportunity of profitable employment for himself and his teams

which he would have if he logged the material and sold it after hauling it to the mill or shipping point.

Unless restricted by the terms of the agreement, the buyer usually cuts very closely. Selling by the lot is therefore a good method to use where the owner intends to clear the land for other uses. For the same reason, if the land is to be kept in timber, the owner should make provision in the contract of sale to retain sufficient control over the logging operations to protect the young growth and provide for a future crop. The importance of care in cutting, on account of its effect upon the succeeding growth and production of the stand, can hardly be overstated.

SELLING BY LOG SCALE

Timber is sold at a certain price per thousand board feet, measured in the log.[10] It is sold either "in the tree," in which case the value of the standing timber is all that is considered, or in the log, cut and delivered at some designated point, in which case the price is based on the stumpage value plus the labor of cutting and transportation.

The chief concern of the owner in selling his standing timber by this method is to determine in advance the true value and price to be charged per unit of measure. This may be secured as (1) an average or "woods run" for the entire lot, or (2) separated by species and, if desired, by grades under each. The latter is the more accurate and satisfactory method. (See p. 23.) How to ascertain stumpage values is discussed on page 36. The owner has the choice of selling only selected and marked trees, or all trees above a certain diameter limit and none others, or, if he chooses, all merchantable trees. Selling only marked trees gives very goood results indeed when the selection is properly done; selling to a diameter limit follows in preference; selling all merchantable trees should not be used in connection with this method, but restricted to sales by the lump or lot, in order to secure full utilization of the lower grades.

Selling standing timber, to be paid for on the basis of the amount determined by scaling up the logs when cut, is one of the most common of methods. A good many sales are made where the owner cuts and delivers the logs to the the mill or shipping point. Because the average farmer is not usually equipped to do an extensive business of this character, the method is mostly confined to relatively small sales and often to the higher-priced woods, such as white oak, yellow poplar, white ash, or black walnut. (Fig. 19.) In selling by the log, the owner who measures and grades his timber,[11] even though he does it roughly, has an advantage over one who is obliged to accept without a check the scale and inspection of the purchaser. In case he has not sufficient experience himself, it will usually pay the owner to hire, if necessary, a competent person to give him instruction in the work.

SELLING BY COUNT

Poles, piling, crossties, small mining timbers, cordwood, etc., are sold by individual count of units of specified sizes.[12] The smaller sizes of bolts, for example, are sold the same s fuel wood by the cord.

[10] In regions where sales are small and values high, it is frequently customary to buy and sell timber by the hundred rather than by the thousand board feet.

[11] See p. 19 for scaling and p. 3 for grading.

[12] See pp. 7 to 19 for specifications.

Because of its simplicity and ease of application, the method has much to recommend it for use wherever it can be applied in timber sales.

SELLING BY LUMBER TALLY

There are two ways of selling timber to be paid for according to the amount of lumber sawed from it in the mill. In the one case, the owner takes no part in the logging and sawing, but disposes of his standing timber at a stumpage price per thousand feet of lumber actually produced at the milll. This method of sale is desirable where conditions are such that the material can be more easily or more reliably measured and checked after leaving the saw than while in the log. It is more applicable also to stands of timber consisting of only a few species than to a mixture of many different kinds. Since mill scales as a rule show from 15 to 30 per cent over-

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FIGURE 19.—A black walnut log, 35 inches in top diameter by 12 feet in length, which brought $135 per thousand feet, or $95.85 for the log, at the railroad. (The original owner, a farmer, sold the whole tree, standing, for $50; the buyer felled it, at a cost of $15, and sold it there for $138.26; it was resold without being moved for $164.84, and later sold to a large sewing-machine factory)

run in excess of log scales in common use, the owner secures returns on the full amount of the product sold. In the other case the owner personally takes charge of the logging and milling and markets the manufactured product. If successful in marketing, he secures the full value of his stumpage and, in addition, a share in the profits derived from the operations of logging and manufacturing. Time, knowledge, and experience necessary to supervise the actual operations or contract for parts of it and capital to finance and carry on the work are requisites.

In this connection it should be clearly recognized that primarily the farmer is a producer and not a manufacturer. His concern, therefore, is in producing and disposing of the raw product, or the timber as it stands in the tree, rather than in logging and milling. However, with teams, wagons, and spare labor available, particularly during the winter months, he can often find profitable employment in logging, or at least in hauling the logs to the mill or shipping point. The sawing must usually be contracted for, because the investment

in sawmill and power outfit would entail too great an expense. In milling and selling, the farmer usually works at a great disadvantage, because he must compete with men whose entire time is devoted to the business. Unless the owner has a definite contract before beginning sawing, he is very likely to find hinnself later on with lumber on his hands for which there is little demand.

EXAMPLES OF MARKETING

The advantage to be gained through a knowledge of marketing timber is best shown by a few actual examples:

(1) A woodland owner in Maryland received an offer of $1,500 for a tract of timber, which he was inclined to accept as a fair price. Before the sale was made, however, he requested the advice of the State forester as to the amount and value of the timber. The State forester made an examination of the tract, estimated the market value of the timber, and furnished the owner a list of timber operators who might be prospective buyers. The timber was then publicly advertised, with the result that the man who had previously made the $1,500 offer raised his bid to $4,500, and the sale was finally made to another person for about $5,500. Only three months elapsed between the date of the first offer and the final sale. Not only was the original offer increased by nearly 270 per cent, but the tract was also left in excellent condition. This was accomplished by having the trees to be cut selected and marked by the State forester with a view to leaving the young growing timber on the ground, together with sufficient seed trees to restock the open places. The contract further called for close utilization by cutting the stumps low and using to small diameters in the tops, the lopping of tops for cordwood, and the scattering of the remaining brush.

(2) An 80-acre farm in south central Michigan had on it a 10-acre wood lot, containing about 48,000 board feet of basswood and about 12,000 each of hard maple, soft maple, red oak, elm, ash, and beech. The trees were overmature, many of them hollow; and the owner knew he ought to "sell them to save them." Timber on an adjacent 10 acres had previously been sold for less than $100 per acre, or a total of about $1,000. Even this value compares well with incomes commonly obtained from wood lots in southern Michigan. Instead of selling on the first bid made, however, the owner, acting on the advice of an expert attached to a near-by forestry school, wrote to a number of wood-using firms in different cities, from some of whom, after examination of his timber, he secured bids on the different species in his wood lot. As a result of his bargaining, he received for his stumpage, in 1913, sums amounting, in the aggregate, to nearly $2,000. For his red oak, bought for quarter-sawing by a firm outside the State, he received $21 per 1,000 board feet. He other trees were purchased by veneer companies, the basswood returning $19 per 1,000 board feet; ash, $16; elm, and hard maple, $14; soft maple and beech, $12.

(3) An owner in northeastern Ohio received bids of $550 and $600 lump sum for this timber. Following the advice of a relative who had previously run a sawmill, he engaged a portable mill, sawed out, and sold the following at the prices named:

(1) White oak butts, rough lumber for wagon stock, hickory butts for bands, and elm butts for hoops, sold for	$1, 350
(2) Barn frame, cut and used on the farm, value	600
(3) 500 railroad ties, sold for	250
(4) Balance, consisting of cheaper poles, "sap timber, cull, and refuse" sold to the buyer who had offered $600 for the standing timber for	350
Gross receipts from timber	2, 550
Total cost of operation	1, 150
Net for stumpage value and profit	1, 100

It will be noted that $600 was the highest bid received for the standing timber, whereas he cleared $1,400.

(4) In western Ohio, a wood-lot owner who had carefully protected his best timber for many years accepted in 1914 a local buyer's lump-

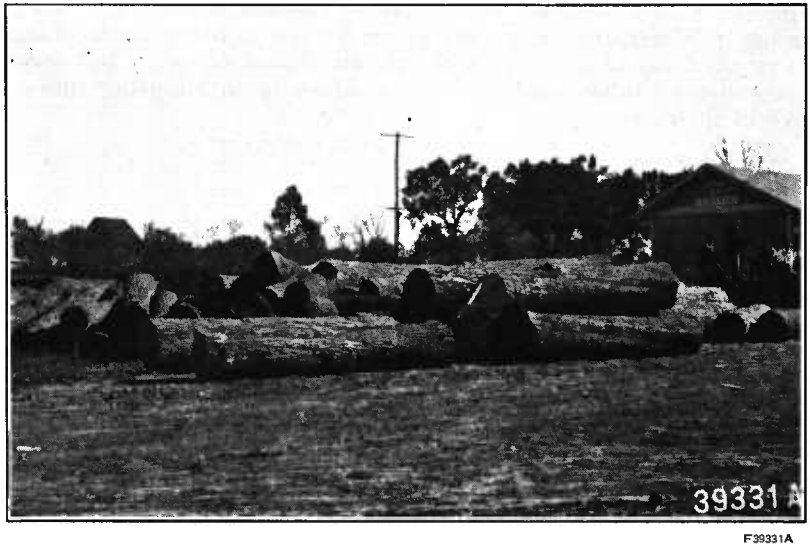

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FIGURE 20.—The owner sold this choice white-oak timber for $5 per thousand feet in the tree. It was located only about a mile from the railroad station, very accessible, and easily worth $16 per thousand feet. An owner of similar timber who knew the market, although located at a greater distance, received from the same buyer $14 per thousand feet

sum offer of $260 for the timber on 6.5 acres. The trees were tall, clean, good-sized white and bur oak of high grade. By a careful measurement of the stumps and tops, made just after logging, the writer found that the tract had yielded not less than 14,500 board feet per acre, or a total of something over 84,500 board feet, allowing 10 per cent deduction for possible further defect than was noted. A fair price for this quality of timber would be $17 per 1,000 feet on the stump. At this rate the timber included in this sale was worth not less than $1,436, or $1,176 more than the farmer received for it. Though this may seem to be an extreme case, mistakes only slightly less striking are common.

TIMBER-SALE CONTRACTS

The owner should draw up a written contract covering every sale of farm-timber products. (Fig. 20.) Even in small sales much

trouble and financial loss have resulted from failure to put the terms of the sale in writing.

The primary aim of the seller should be to make absolutely clear the conditions under which he desires to dispose of his product. The essential conditions to be inserted in the complete form of timber-sale contract refer to (1) description and location of the timber; (2) price and manner of payment; (3) conditions of cutting and removal; and (4) title and means of settling disputes. Under the third heading are put down the provisions regarding the duration of the contract, the marking of the timber, the diameter limits, the method of scaling, merchantability, the degree of utilization, and protection against injury.

As an aid to those unfamiliar with such agreements, a sample contract is given, showing the more important provisions that should be included in a contract for the sale of marked trees to be scaled in the log. Substitute clauses are given for use in other kinds of sales. No single form of contract will suit all classes of sales, but owners of woodland timber should have no difficulty in adapting this contract to their use.

SAMPLE TIMBER SALE CONTRACT

Timber contract

Agreement entered into this 16th day of November, 1929, between James Boyd, of Centerdale, Ohio, hereinafter called the seller, and Thomas B. McCord, of New Albany, Ohio, hereinafter called the purchaser.

Witnesseth:

ARTICLE 1. The seller agrees to sell to the purchaser, upon the terms and conditions hereinafter stated, all the living timber marked or designated by the seller and all merchantable dead timber, standing or down, estimated to be 84,000 board feet, more or less, on a certain tract of land situated in the township of Centerdale, county of Tompkins, State of Ohio, and located on the farm belonging to the seller, and about one-half mile west of his farmhouse.

ART. 2. The purchaser agrees to pay the seller the sum of seven hundred dollars ($700), more or less, as may be determined by the actual scale, at the rate of fourteen dollars ($14) per thousand board feet for white oak and white ash, twelve and 50/100 dollars ($12.50) for red oak and hickory, eight dollars ($8) for sugar maple and beech, and six dollars ($6) for black gum, blue beech, and ironwood, payable prior to the date of removal of material, in installments of two hundred dollars ($200) each.

ART. 3. The purchaser further agrees to cut and remove said timber in strict accordance with the following conditions:

1. Unless extension of time is granted, all timber shall be cut, paid for, and removed on or before March 30, 193—.

2. Saw timber shall be scaled by the ——— log rule, and measured at the small end along the average diameter inside the bark to the nearest inch.

3. The maximum scaling length of logs shall be 16 feet; greater lengths shall be scaled as two or more logs. Upon all logs an additional length of 4 inches shall be allowed for trimming. Logs overrunning this allowance shall be scaled not to exceed the next foot in length.

4. No unmarked timber of any kind shall be cut, except black gum, blue beech, and ironwood.

5. Stumps shall be cut so as to cause the least possible waste; stumps of trees up to 16 inches in diameter not higher than 12 inches above the ground, and those of trees above this size at a distance above the ground not greater than three-fourths of their diameter.

6. All trees shall be utilized in their tops to the lowest possible diameter for commercially salable material.

7. Young trees shall be protected against unnecessary injury; only dead trees and the less valuable kinds may be used for construction purposes in connection with lumbering operations.

8. Care shall be exercised at all times by the purchaser and his employees against the starting and spread of fire.

ART. 4. It is mutually understood and agreed by and between the parties hereto as follows:

1. All timber included in this agreement shall remain the property of the seller until paid for in full.

2. In case of dispute over the terms of this contract, final decision shall rest with a reputable person to be mutually agreed upon by the parties to this contract; and in case of further disagreement, with an arbitration board of three persons, one to be selected by each party to this contract and a third to be the State forester or his chosen representative.

In witness whereof the parties hereto have hereunto set their hands and seals this ——— day of ———, 193—.

Witnesses:

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The following are specimens of clauses that should be substituted in the contract when other methods of sale are used.

In lump-sum sales substitute in article 1 a descriptive clause modeled on this one:

All merceantable living trees, except yellow poplar, white ash, and basswood, which measures 12 inches and below in diameter at breastheight (a height of 4½ feet above the ground).

This provision will reserve the basis for a second crop consisting of the more valuable and rapid-growing kinds of trees, and remove all of the inferior and slower-growing trees.

In a sale to a diameter limit the clause should read somewhat as follows:

All merchantable living trees, 12 inches and over, measured at breastheight above the ground.

The payment clause in lump-sum sales should be varied to read something like this:

* * * the sum of ——— dollars ($———) for said timber, payable prior to the cutting of the material, in installments of ——— dollars ($———) each, payable on or before ———, respectively.

Other clauses which might be included are those requiring that the timber shall be scaled in the presence of the seller or his authorized agent; that the log lengths shall be varied so as best to utilize the timber; that unmarked trees, if cut, shall be paid for at double the regular pirce; that tops left in logging shall remain on the tract for the use of the seller (or, if desired, shall be utilized by the purchaser).

In selling by lump the other esesntial change is to omit the provisions, or parts of them, referring to scaling, measuring, and unit prices. The total amount to be paid is very important, while the total estimated quantity of timber is optional.

THE SMALL SAWMILL

Practically all that has been said in regard to the marketing of lumber by the farmer applies equally to the owner of a small portable sawmill. The small millman's interest is closely related to that of the woodland owner, since the prosperity, success, and profit of both are dependent upon the millman's ability to manufacture carefully [13] and market to good advantage. If the millman shows good management in handling his business, the farmer who sells him his raw materials is certain in the end to obtain larger prices for his

[13] Department of Agriculture Bulletin 718, Small Sawmills.

stumpage. In fact, practical assistance in marketing given to the small millmen will undoubtedly prove effective in assisting the small owner to secure the full value of his timber. (Fig. 21.)

It is to the advantage of both the owner who manufactures his product and the millman who buys and saws the farmer's standing timber to work up the logs into the most salable form. In advance of sawing, it is well to secure a definite contract, or at least follow a lumber bill which conforms to standard market requirements of special industrics. Advance orders call for stated quantities of material of specified kind, sizes, and grades. The operator of a small portable sawmill is likely to lose money if he saws without due regard for the market requirements in material, sizes, and grades. Investi-

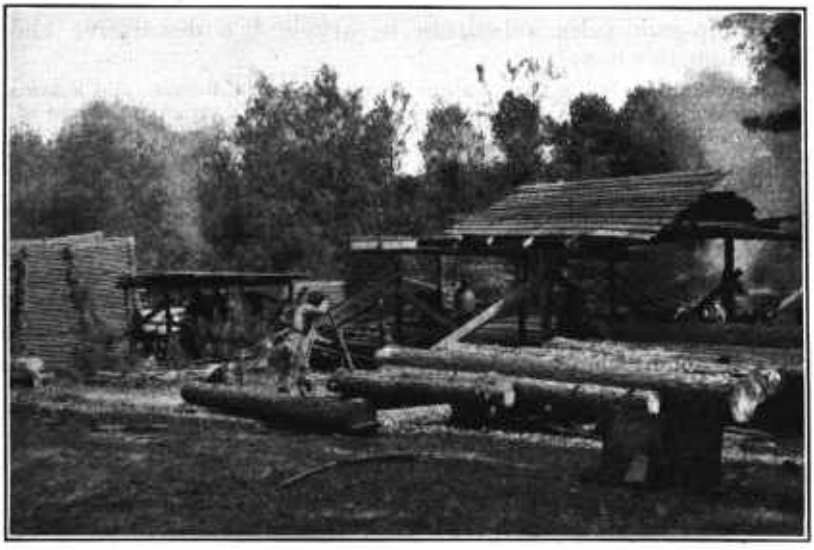

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FIGURE 21.—Operations at a small portable sawmill cutting about 12,000 board feet daily

gate the market first, then proceed to cut up the timber. This applies equally to cutting up logs in the woods and running the logs through the sawmill. Great waste, with consequent reduction in profit, results from failure to locate the market before beginning to harvest the crop. Undoubtedly, the present custom had its origin in the customary method of harvesting field crops. The timber crop is, however, essentially different from the field crop in one respect, namely, that there is seldom any necessity for quick harvesting.

COOPERATION IN MARKETING

There is unquestionably a clear and definite need for cooperation among owners in the selling of woodland products. The average farmer by himself acts at a great disadvantage, because the whole field of caring for growing timber, selecting trees for cutting, and finding the best market is unfamiliar ground.

Because he has not a carload lot of a particular kind of material and shipment by local freight is absolutely prohibitive, the owner

is obliged in many instances to cut up choice kinds of material into very inferior products; for example, he may find it necessary to turn clear white oak or black cherry into railroad ties and sell his material at a great sacrifice to a local buyer—a middleman. Several farmers acting cooperatively could market their black-walnut logs, basswood, hickory or oak bolts, piling, or other products direct to the wholesaler, manufacturing plant, or user at greatly increased profits over those received from their individual sales.

The services of a reliable and experienced timberman as adviser would be extremely helpful to the majority of farmers. The services of such a man, who is known to be working in the interests of the farmer, are needed: (1) To estimate the contents and market value of woodlands. The owner will then be in a better position to decide how to sell most profitably. (2) To supervise the marketing of timber in carload lots. Because of his superior knowledge such an adivser will be much better fitted to secure current market prices than the average farmer.

In regions where timberwork has been going on for many years men of the necessary qualifications will be quite readily found. They should be selected under the approval of the State forester in States where such an officer is employed. The farmers' timber adviser should be clearly identified with such organizations as the county improvement associations or with the State extension service. The farmer might pay a fair price for each piece of estimating and selling, or each county might employ a man whose duty it would be to advise the farmers. Several farmers acting cooperatively could secure the services of the timber agent at relatively small cost to each.

No attempt is made here to work out and recommend a plan of cooperation. This could undoubtedly be effected through the aid of the State and Federal Governments in conjunction with the present farm demonstration and management movement for better buying and selling on the part of farmers. Groups desiring to effect permanent organization can secure assistance and information as to methods and procedure from the marketing and rural organization specialists of the State departments of agriculture and of the United States Department of Agriculture. (Figs. 22 and 23.)

HOW TO PREVENT THE DETERIORATION OF CUT WOOD PRODUCTS

A good rule to follow is to allow as little delay as possible between the felling of the tree and its manufacture into rough products. This means that sales should be arranged for prior to beginning cutting. It is often necessary or desirable, however, to put off the delivery of logs, bolts, poles, etc., until some months after cutting, either in order to allow them to season or because a good sale can not be arranged at once. A great deal of the weight of freshly cut products is due to the water they contain, and a few months' seasoning will often reduce this to a marked degree, the amount of reduction depending, of course, on the climate, the weather, and the exposure to sun and air. At the same time, unless preventive measures are taken, the products are sure to deteriorate through decay, insect attack, checking, or some other agency. A certain amount of deterioration is apt to take place in any case if the delivery is put off for some time, but the amount can be greatly reduced by proper preventive measures.

F21151

FIGURE 22.—Northern maple woods yielding a by-product of much value. The maple-sirup industry brings good wages to the farmer and his teams during a dull season on the farm

F165320

FIGURE 23.—The resin, or gum, of the longleaf and slash pines of the South yields turpentine and rosin. The gum is now widely regarded as a cash farm-timberland product

Logs and other round timber should never be allowed to remain long in the woods after cutting. As soon as possible they should be taken to a dry, well-aired, and shaded area and placed on skids well off the ground; otherwise the opposite extreme should, if possible, be adopted, namely, of keeping the timber in water. Within a few days after the trees are felled the bark should be removed from poles, posts, and other material which will not be injured by checking or season cracks. The ends of logs should be coated with paint, creosote, or tar. This will not only assist in preventing decay, but will also retard seasoning to some extent and thus keep the logs from checking badly.

Poles should be peeled and hauled or dragged to a place free from débris or rank vegetation and freely exposed to sun and wind. They should be rolled upon skidways not less than 18 inches high, so that no part of them will rest on the ground. There should be only one layer of poles on each skidway. When ties are cut, it is usually cheapest and most desirable to haul them, unseasoned, directly to the railroad and there pile them according to the specifications furnished by the tie buyer.

Cordwood should be stacked in loose piles in a sunny, well-aired, and well-drained place free from rank vegetation. Two sticks on the ground running the length of the pile will keep it from contact with the soil and thus prevent decay in the lower layers.

PRACTICAL HELPS IN MARKETING

The following suggestions may be helpful in the selling of timber products:

Find out from as many sawmills and wood-using industries as possible what prices they offer for various wood products, in order that advantage may be taken of the best market. This applies to sales requiring shipment as well as to local sales.

Before selling, inquire from neighbors who have recently disposed of their timber and use their experience as a guide. Consult your county agent. Failure to do this has resulted in many instances in not getting the full value of the product.

Thoroughly investigate all local timber requirements and prices, since in many cases local markets pay better prices than outside markets because of the saving of transportation charges.

Advertise in the papers and otherwise secure competition among outside purchasers. The expense will be small and outside buyers will thus learn of chances to bid on timber in competition with local buyers.

Secure bids whenever practicable both by the lump and by log-scale measure. A choice is thus offered and the more profitable form of bid can be accepted.

Consider the responsibility of the prospective purchaser before making the sale in order to avoid slow payment, costly collections, and losses.

Prior to making sales, secure at least a fairly good estimate of the amount and value of the material for sale. Persons acquainted with the business of measuring or estimating timber can usually be found in every region where timber has been handled in the past.

Market the higher grades of timber instead of using them on the farm for purposes for which cheaper material will prove as serviceable. This should be done in many cases, even if it makes necessary the purchasing and hauling of lower priced lumber to the farm. Markets which pay good prices usually buy on grade and inspect closely.

Remember that standing timber does not deteriorate rapidly nor do the uses of wood change greatly within a few years. The owner, therefore, is not forced to place his product on the market regardless of market conditions.

Use a written timber-sale agreement in selling farm timber, particularly where the cutting is done by the purchaser.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

March 21, 1930

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